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February 15, 1990

Energy Research Abstracts

Abstracts 4551–6494

Office of Scientific and Technical Information
UNITED STATES DEPARTMENT OF ENERGY

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Energy Research Abstracts

Purpose

Energy Research Abstracts (ERA) provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U.S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. Foreign information is obtained through the International Energy Agency's 14-nation Energy Technology Data Exchange, the International Atomic Energy Agency's International Nuclear Information System, or nation-to-nation agreements. **Please note that *ERA* coverage of nonreport literature is limited to that generated by Department of Energy activity.**

Scope

ERA is comprehensive in its subject scope, encompassing DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

The citations presented in *ERA* are available for on-line searching as records within the Energy Data Base. The current-year records are available on the Integrated Technical Information System (ITIS). The entire data base is available through commercial on-line vendors.

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Managing Editor, Audrey B. Smith
Technical Editor, M. Catherine Grissom

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The citations presented in *Energy Research Abstracts* are a subset of the worldwide energy information provided to the Office of Scientific and Technical Information (OSTI) through exchange agreements with foreign sources and through exchanges or contracts with U.S. organizations.

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In the exercise of its rights and responsibilities under the agreements to which it is a party, the **Office of Scientific and Technical Information** both receives information from the above sources and submits U.S.-produced information to them. In addition to materials generated by the Department of Energy, this U.S.-produced information is gathered from other government agencies as well as under contract with private information processing companies. All input is computer processed and entered into a data base for on-line retrieval. The data base serves as well for the production of numerous OSTI publications.

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The coverage of literature in this publication includes several document types, ranging from technical reports to journal articles to books. The principal data elements included in these citations are:

1. **Abstract number** within volume.
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3. **Title and subtitle** (non-English title may appear in parentheses, if applicable).
4. **Author(s).** First 10 names in the data record are printed, then "et al." is listed.
5. **Author affiliation.** Only first one is listed, in parentheses after author(s) to which it applies.
6. **Collaboration,** if present.
7. **Corporate author(s)** identifying corporation responsible for document.
8. **Patent assignee and number** for citations of patent documents or applications.
9. **Journal title, volume, and issue** for citations of journal articles.
10. **Date of publication.** If not known, a processing date is in brackets.
11. **Number of pages** or page range.
12. **Language** of document if non-English.
13. **Monograph title** if citation is an analytic (part, chapter, or paper) of a larger monograph.
14. **Publisher's name and location** for documents published by a corporate or commercial source.
15. **Sponsoring organization.**
16. **Contract or grant number.**
17. **Secondary identifying number;** may be a conference number.
18. **Conference title, location, and date,** if applicable.
19. **Order number.** The "DE" order number may be used for ordering from NTIS or OSTI, as appropriate. The "TI" prefix is valid only at OSTI.
20. **Sources of availability** from which a copy of the document may be obtained; usually appear as abbreviations. (See information on following page.)
21. **Drop note** or explanatory statement.
22. **Abstract.**
23. **Subject descriptors.** Listed only if no abstract or only a brief statement is included.

Sample Citations

Report

1849 (DOE/ER/40438–T1) **[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report.** Haeberli, W. Phys. VI collaboration. Wisconsin Univ., Madison (USA). Dept. of Physics. [1989]. 12p. Sponsored by DOE Energy Research. DOE Contract FG02-88ER40438. Order Number DE89007246. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper briefly discusses the Wisconsin test facility for storage cells; results of target tests; the new UHV...

Report Analytic

18500 (INIS-SU—69, pp. 30-32) **Transition energies in Ne-like ions. Correlation effects.** Vainshtejn, L.A. AN SSSR, Moscow. Fizicheskij Inst. 1988. (In Russian). In *Experimental and theoretical physics. Collection.* Order Number DE89780060. Available from NTIS (US Sales Only), PC A03/MF A01; INIS.

Kratkie Soobshcheniya po Fizike.; no. 6.

SILVER IONS/energy-level transitions; XENON IONS/energy-level transitions; CORRELATIONS; D STATES; E STATES;...

Journal Article

19055 **A theoretical and experimental investigation of long-pulse, electron-beam-produced rare gas plasmas.** Brake, M.L.; Repetti, T.E. (Energy Beam Interaction Lab. of the Dept. of Nuclear Engineering, Univ. of Michigan, Ann Arbor, MI (US)). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science (USA),* 16(5): 581-589 (Oct 1988). (CONF-881020–: Symposium on radiation physics, Sao Paulo, Brazil, October 3, 1988).

Visible emission spectroscopy (380-650 nm) has been performed on intense, electron beam (1 kA, 300 ns, 300 kV) produced Ar, Kr,...

Patent

18045 **Polarization of fast particle beams by collisional pumping.** Stearns, J.W. To Dept. of Energy, Washington, DC. USA Patent 4,724,117. 9 Feb 1988. Filed date 19 Oct 1984. vp. Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

A method for polarizing a fast beam of particles by collisional pumping, comprising the steps of generating a beam...

How To Order from the Availability Sources

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Report literature, usually identified by an alphanumeric identifier at the beginning of a citation, is available from the sources listed in the citation (see example of element 20 on page iii). Often the sources are listed as abbreviations. Corresponding addresses are provided at right from which documents with these abbreviations may be ordered. When "OSTI" is given, **DOE and DOE contractors may order these documents from OSTI.** (However, check with your library or information organization which may require that orders go through them to OSTI.) The public should order from NTIS or from one of the other agencies listed in the citation. To expedite processing, an order form is provided in the back of this publication. NOTE: The order numbers provide quicker access for report ordering. Use the order number where possible.

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Journal articles *Chemical Abstracts Service Source Index (CASSI)* tells which libraries, both U.S. and foreign, contain a journal and the available years. *Ulrich's International Periodicals Directory* contains information on the journal and its publisher. For librarians, another source of information is On-Line Computer Library Center (OCLC), for interlibrary loans.

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Library of Congress
National Translation Center
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United Kingdom

How To Use the Indexes

Five indexes are provided for approaching the content of each issue of *Energy Research Abstracts.* Descriptions of entries in these indexes follow.

Corporate Author Index
The corporation, organization, or institution responsible for the issuance of the document is listed in this index. The entries are arranged alphabetically and provide the title and citation number of the reference. For example, the listing for the "Report" sample citation would appear as shown at right.

Wisconsin Univ., Madison (USA). Dept. of Physics
[Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)
Wisconsin Univ., Madison (USA). Lab. of Genetics
Organization of the R chromosome region in maize: Final progress report, June 1, 1983–May 31, 1986, 15:18255 (R;US)

Personal Author Index
Each author's name listed on a document cited in this issue is indexed. An index entry provides title and citation number; for secondary and other names, a cross-reference is given to the primary author name where the full index entry is located.

Hadley, D.L., *See* Lee, A.D., 15:17651
Haeberli, W., [Development of a hydrogen and deuterium polarized gas target for application in storage rings]: Progress report, 15:18494 (R;US)

Subject Index
This index lists the main subject descriptors assigned to each record by indexing professionals. A secondary or qualifier term is used where necessary to describe materials, objects, and processes. Document titles may be enhanced with additional informative phrases where necessary. An excerpt from this index appears at right.

HYDROGEN ISOTOPES
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HYDROGEN 4
TRITIUM
Neutron-Rich Isotopes
Study on the strong neutron-rich nuclei of lightest elements, 15:18686 (RA;SU;In Russian)

Contract Number Index
DOE technical reports are listed by contract number. Each entry also provides the primary corporation or organization cited for that contract number. A typical entry is shown.

FG02-88ER40438 **Wisconsin Univ., Madison (USA). Dept. of Physics**
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FG02-88ER60664 **Rogers and Associates Engineering Corp., Salt Lake City, UT (USA)**
15:17641 DOE/ER/60664–1

Report Number Index
Technical report literature is indexed by the alphanumerical identifier of the report. Patent documents and conferences are included for convenience. Each entry lists the citation number, the source of availability of the document, an indicator of presence at a GPO depository library, order number, and distribution category. A typical entry is:

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Subject Contents

The subject content of *Energy Research Abstracts* is arranged as shown below. The two-digit and four-digit category numbers printed here illustrate the category number assignment used in the data base records.* The following list includes all of the 39 first-level and the 308 second-level categories. Because each issue of *ERA* publishes citations only for those documents announced during the past semimonthly period, some subject categories may not be present in every issue.

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*The numerical subject category scheme is used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's data systems. Categories and definitions for the complete set of six-digit numbers are given in DOE/TIC-4584, *Energy Data Base: Subject Categories and Scope.*

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Energy Research Abstracts

01 COAL, LIGNITE, AND PEAT

4551 (CMRC–8901) **Proceeding of the 9th Presentation Meeting on Coal Utilization Technology.** Coal Mining Research Centre, Tokyo (Japan). Aug 1987. 432p. (In Japanese). Order Number DE90725021. Available from NTIS (US Sales Only), PC A19/MF A01.

Proceeding of the 9th Presentation Meeting on Coal Utilization Technology is compiled. On coal-fired boiler; utilizing a low grade import coal, development of fluidized bed technologies which are enabled to reduce the environmental cost using desulfurizing agent, are promoted. A high fineness mill is developed corresponding to needs of the CWM (coal water mixture). A CCS (coal cartridge system) demonstration test is being conducted for easy handling and enlarging the use of coal. Development of CWM as a fuel for industrial use is carried out, practical tests are conducted in the manufacturing, storage, transportation and combustion, however its high fixed cost (40-50%) and ash treatment are problematical. As effective uses of coal ash; cement replacement, slurried ash, use in civil engineering and recovery of valuable matters, are described. In coal gasification, development on a hot gas cleanup technology for integrated gasification combined cycle power generation, is reported. In coal liquefaction, a coal data base which is adapted for NEDOL process, is reported. Development of a formed coke process for a blast furnace is described. 82 refs., 364 figs., 151 tabs.

4552 (FSJ–8902) **Proceeding of the 25th Coal Science Conference (1988).** Fuel Society of Japan, Tokyo (Japan). 10 Nov 1988. 288p. (In Japanese). Order Number DE90724915. Available from NTIS (US Sales Only), PC A13.

Proceeding of the 25th Coal Science Conference (1988) is compiled. On the coal liquefaction; reaction kinetics analysis, hydrogen shuttler, deashing pretreatment, effect of preheat treatment, and so on, are presented. On the study of solvent; solvent extraction on supercritical condition, properties of recycle solvent and its effect, are reported. On brown coal liquefaction; effect of chemical compositions in solvent on the liquefaction, demonstration operation result of NEDOL process, are described. On the reaction mechanism of coal liquefaction; experimental result and theoretical elucidation, specific behaviours of various catalysts and activity lowering, are presented. On the coal gasification; material and thermal balance, various catalysts and gasification with calcium hydroxide, ash fusion, are investigated. On the liquefaction residues, relevance between solvent extraction and pyrolysis is studied. For the high-grade utilization of coal, rapid pyrolysis, utilization for heavy oil upgrading, oxidation reforming of the liquefaction residues, are also studied. For removal of the harmful components, various coal cleaning methods are investigated. On measurement and analysis; biological marker, C-NMR, chromatographic analysis and so on are described. 208 refs., 252 figs., 148 tabs.

0103 Preparation

Refer also to citation(s) 4600, 4601, 5545, 5546

4553 (DOE/PC/88882–T4) **Ancillary operations in coal preparation instrumentation: On-line low cost sulfur and ash analysis: Third quarterly report, July 1989–September 1989.** Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div. [1989]. 53p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88882. Order Number DE90003034. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objective of this project is to design, fabricate, and field test an on-line sulfur and ash analyzer to be used on coal slurry streams such as those found at coal cleaning plants. Progress on project planning, budget, and a brief summary of a review meeting with DOE is also included. 1 tab.

4554 (DOE/PC/88883–T4) **Development of the Electroacoustic Dewatering (EAD) process for fine/ultrafine coal: Fourth quarterly progress report, period ending September 30, 1989.** Muralidhara, H.S. (Battelle Memorial Inst., Columbus, OH (USA)); Jirjis, B.F.; Senapati, N.; Menton, R.; Hsieh, P.; Chiang, S.H.; Cheng, Y.S.; Chauhan, S.P. Battelle Memorial Inst., Columbus, OH (USA). 30 Oct 1989. 24p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88883. Order Number DE90003309. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report describes an advanced process, called Electroacoustic Dewatering (EAD), which capitalizes on the adaptation of synergistic effects of electric and acoustic fields to commercial coal dewatering systems, such as belt filter presses. Objectives are: (1) to validate the expected technical feasibility and energy conservation/economic benefits of the EAD process as applied to fine (−100 mesh) and ultrafine (−325 mesh) coal; and (2) to obtain data from a continuous, process research unit (PRU) in order to conduct a reliable economic analysis and to design commercial EAD filters as well as to promote adaptation of the process by the coal preparation industry. During this quarter, our efforts were focused on material selection, acquisition, and characterization and on laboratory EAD tests. 8 figs., 6 tabs.

4555 (DOE/PC/88884–T4) **Pitt Mill demonstration: Quarterly technical progress report, July 1, 1989–September 30, 1989.** EXPORTech Co., Inc., New Kensington, PA (USA). [1989]. 16p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88884. Order Number DE90002762. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Task 3.4, Grinding Comparison Study, was completed during this period. This report presents the results of the Prototype Mill Grinding (Task 3.4.1), Commercial Grinding (Task 3.4.2) and Analysis of Comparison Grinding Results (Task 3.4.3). Three different coals were used in the study: Pittsburgh #8, Pocahontas and Mingo County coals. The petrographic and chemical compositions of the test coals were markedly different, allowing the comparison of the technologies on radically different materials. The commercial grinding was carried out at Netzsch Inc., in Exton, PA. The report also covers the petrographic characterization of Mingo County coal. Petrographic analyses of the other two test coals have been given in previous reports. 5 figs., 13 tabs.

4556 (PB–89-873723/XAB) **Coal desulfurization. January 1970-August 1989 (Citations from the COMPENDEX data base). Report for January 1970-August 1989.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 90p. Available from NTISPC N01/MF N01.

Supersedes PB–88-859145.

This bibliography contains citations concerning physical, chemical, and microbiological methods utilized in the removal of sulfur from coal. Oxydesulfurization, washing, electrochemical separation, oxidation, molten salts, microwave radiation, biodegradation, supercritical extraction, magnetic techniques, chlorinolysis, and flotation are among the processes considered. Sulfur pollution standards, environmental regulations and considerations, and process analyses and evaluations are discussed. Desulfurization of coal-derived liquids and coal liquefaction are examined in separate bibliographies. (This updated bibliography contains 212 citations, 41 of which are new entries to the previous edition.)

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Refer also to citation(s) 4556, 4743, 5403

4557 (ARC/CR–YCLQ-14) **Optimal reactor distribution with fixed terminal constraints.** Gibb, W. (Alberta Research Council, Edmonton, AB (Canada)); Ozum, B.; du Plessis, M.P. Alberta Research Council, Edmonton, AB (Canada). Coal Research Dept. 1982. 80p. (CE–02430). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: $0.34 CAN per page, $3.40 minimum.

A feasibility study was conducted on a 60,000 bbl/d coal liquefaction plant. The study estimated the total cost of the chemical reactors in the conversion unit to be $150 million, and suggested that each train of reactors have 3 reactors of each of equal volume. This is optimal only for the case where the reaction rate is directly proportional to the concentration of unconverted coal. If the reaction rate is nonlinear there is a distinct optimum which requires that the reactors be different in size. This report details the calculations performed as a first step towards obtaining an optimal reactor number and size distribution that is compatible with the plant parameters in the feasibility study. The cost function is defined and expressed as a function of the containment volume of each of the reactors. The numerical algorithm used to solve the system of equations is presented. A reaction rate vs unconverted coal concentration relationship is assumed which is used to establish the explicit system of equations. It is seen that for each of the assumed rate expressions, little is gained by using more than 3 reactors; however, the additional saving by using 4 reactors may be significant depending on the discretization costs. The greater the departure of the reaction rate expression from the linear case, the greater the saving. Computer program listings used in the calculations are included. 1 ref., 8 figs.

4558 (BNL–42489) **Economical clean carbon fuel and co-product gaseous and liquid fuel from coal.** Steinberg, M.; Grohse, E.W. Brookhaven National Lab., Upton, NY (USA). Sep 1989. 22p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC02-76CH00016. (CONF-891130–2: 3. international conference on processing and utilization of high-sulphur coals, Ames, IA (USA), 14-18 Nov 1989). Order Number DE90003629. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The HYDROCARB Process converts coal or other carbonaceous feed to a clean carbon fuel and co-product gaseous hydrogen- and/or methane (CH_4)-rich gas and/or liquid methanol. Feedstock carbon content is essentially extracted as pure particulate carbon, free of sulfur, nitrogen, and ash. A combustion system burning such a fuel would not require postcombustion ash handling and emissions control, especially difficult when burning high sulfur coals. By eliminating the need to manufacture large quantities of hydrogen, lower capital cost and higher thermal efficiency result compared to previous coal-to-synthetic-fuel processes, allowing production of carbon fuel at a price competitive with current energy prices. Combustion testing has shown that carbon fuel can be burned in conventional combustion equipment with minimum modification. 8 refs., 4 figs., 6 tabs.

4559 (CONF-8910280–2) **Materials testing and failure analysis activities at the Wilsonville Advanced Coal Liquefaction Research and Development Facility.** Judkins, R.R.; Keiser, J.R. Oak Ridge National Lab., TN (USA). [1989]. 31p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC05-84OR21400. From Joint meeting of the U.S. DOE (PETC)/Japan AIST-NEDO Committee on Coal Liquefaction; Tokyo (Japan); 27 Oct - 10 nov 1989. Order Number DE90002465. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Oak Ridge National Laboratory (ORNL) has for over ten years provided materials testing and failure analysis services to various coal conversion and utilization facilities in the United States. ORNL was involved in these types of activities at all four of the major coal liquefaction pilot plants. This paper presents a summary of activities at Wilsonville over the past two and one-half years. Some details of these activities are discussed below. Failure analysis of elastomers, stainless steels, and alloys is discussed. 6 refs., 9 figs., 13 tabs.

4560 (DOE/MC/21063–2740-Vol.1) **A 50-month gasifier mechanistic study and downstream unit process development program for the pressurized ash-agglomerating fluidized-bed gasification system: Volume 1: Final report, August 1984–September 1988.** Haldipur, G.B.; Schmidt, D.K.; Smith, K.J. KRW Energy Systems, Inc., Madison, PA (USA). Mar 1989. 178p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-84MC21063. Order Number DE89011704. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

This technology development program scope included studies of those processes and components necessary to convert coal, oxidant and steam into a clean fuel gas. The configuration of the processes and components constitutes a Gasifier Island which is a key concept in the application of the KRW gasification and cleanup technologies. This Gasifier Island typically consists of process units that perform the following functions: feedstock preparation, gasification, desulfurization, heat recovery, particulate removal, and solid waste treatment. The processing has been conducted in a variety of gasifier operating modes including air-blown and oxygen-blown, both with and without in-bed desulfurization which includes injection of limestone or dolomite sorbent. Process configurations downstream of the gasifier have included recycle and non-recycle cyclones, sintered filters, and zinc ferrite fixed beds. Because of the developmental nature of the KRW technology program and the flexibility of the pilot plant itself, a wide range of gasifier-cleanup process configurations has been investigated. The KRW pilot plant program evaluated a system comprised of the following major process elements: gasifier and in-bed desulfurizer, particulate cleanup train, external sulfur polishing bed, and solid waste disposal system.

4561 (DOE/MC/21063–2740-Vol.2) **A 50-month gasifier mechanistic study and downstream unit process development program for the pressurized ash-agglomerating fluidized-bed gasification system: Volume 2: Final report, August 1984–September 1988.** Haldipur, G.B.; Schmidt, D.K.; Smith, K.J. KRW Energy Systems, Inc., Madison, PA (USA). Mar 1989. 161p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-84MC21063. Order Number DE89011705. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

This document describes the general and specific requirements for the implementation of gasifier tests at the KRW pilot plant. In addition, this document defines the methods and suggested tolerances for the screening, analysis and reporting of operational data. This revised operational plan encompasses the additional requirements derived from the In-bed Desulfurization Program and incorporates refinements made in gasifier operation since January 1980. General objectives: demonstrate process operability during extended-duration runs with selected coal feedstocks; provide assurance that solids accumulations inside process vessels either do not form or do not inhibit prolonged operation; verify a firm basis for design and scale-up of the gasifier and for and other equipment peculiar to the KRW process; generate concise, documented material balances from pilot plant test data to include compositions, quantities, and conditions of the process streams; and obtain reliable process performance results to evaluate the technical and economic feasibility of the pressurized ash agglomerating gasifier and advanced downstream cleanup systems.

4562 (DOE/PC/79936–4) **Low severity conversion of activated coal: Quarterly report no. 4, June 1, 1988–August 30, 1988.** Hirschon, A.S.; Ross, D.S.; Ackerman, L. SRI International, Menlo Park, CA (USA). Oct 1988. 14p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC79936. Order Number DE90003224. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objectives of this project are to: develop an understanding of hydrothermal pretreatment chemistry and its optimization at temperatures and pressures no greater than 250°C and 1000 psi, develop a series of highly reactive and dispersible promoters of bond hydrogenolysis operating at temperatures no greater than 300°C, and successfully combine the pretreatment and hydrotreating steps to obtain high yields of toluene-soluble coal products. This quarter, aqueous pretreatments continued with ammonia as an additive, CoMo thiolate cluster catalysts were prepared and tested, and experiments were conducted in which KOH catalyst was replaced by either NH_4MoO_4 or NH_4MoS_4 catalysts. Results are discussed. 14 refs., 2 figs., 3 tabs. (CBS)

4563 (DOE/PC/79936–6) **Low severity conversion of activated coal: Quarterly report No. 6, December 1, 1988–February 28, 1989.** Hirschon, A.S.; Ross, D.S. SRI International, Menlo Park, CA (USA). May 1989. 15p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC79936. Order Number DE90003225. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objectives of this project are to: develop an understanding of hydrothermal pretreatment chemistry and its optimization at temperatures and pressures no greater than 250°C and 1000 psi, develop a series of highly reactive and dispersible promoters of bond hydrogenolysis operating at temperatures no greater than 300°C, and

successfully combine the pretreatment and hydrotreating steps to obtain high yields of toluene-soluble coal products. This quarter work continued on aqueous pretreatments and dispersion of molybdenum, cobalt, and a mixture of molybdenum-cobalt complexes within the coal. 9 refs., 3 tabs. (CBS)

4564 (DOE/PC/79936–7) **Low severity conversion of activated coal: Quarterly report no. 7, March 1, 1989–May 30, 1989.** Hirschon, A.S.; Ross, D.S. SRI International, Menlo Park, CA (USA). Aug 1989. 13p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC79936. Order Number DE90003226. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objectives of this project are to: (1) develop an understanding of hydrothermal pretreatment chemistry and its optimization at temperatures and pressures no greater than 250°C and 1000 psi, (2) develop a series of highly reactive and dispersible promoters of bond hydrogenolysis operating at temperatures no greater than 300°C, and (3) successfully combine the pretreatment and hydrotreating steps to obtain high yields of toluene-soluble coal products. This quarter, aqueous pretreatments continued, and the following catalysis were evaluated: molybdenum cobalt cluster with sulfur; a molybdenum acetate dimer; and a sulfur-containing iron cluster. 9 refs., 2 tabs. (CBS)

4565 (DOE/PC/88891–T2) **Molecular biological enhancement of coal biodesulfurization: Fourth quarter report, August–October 1989.** Bielaga, B.; Kilbane, J.J. Institute of Gas Technology, Chicago, IL (USA). Oct 1989. 17p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88891. (IGT–61095). Order Number DE90003293. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The overall objective of this project is to use Molecular Genetics to develop strains of bacteria with enhanced ability to remove sulfur from coal, and to obtain data that will allow the performance and economics of a coal biodesulfurization process to be predicted. The work planned for the current quarter includes the following tasks: isolation and analysis of mutations, cloning of "4S" genes, analysis of cloned DNA, and use of molecular genetics to increase the selective pressure for the isolation of desulfurization-competent microorganisms. Work performed during this quarter is reported under two topics: development of genetic techniques, and biochemical analysis of desulfurization-proficient and desulfurization-deficient strains of IGTS8. 1 fig., 3 tabs.

4566 (DOE/PC/88920–T5) **Electrochemistry of Thiobacillus ferrooxidans reactions with pyrite: Technical progress report, August 15–October 15, 1989.** Pesic, B.; Kim, I. Idaho Univ., Moscow, ID (USA). Coll. of Mines and Earth Resources. 1989. 29p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-88PC88920. Order Number DE90003037. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

The interactions of mineral-pyrite with T. ferrooxidans were studied by using a cyclic voltametry technique. The interactions with bacteria were carefully examined during the entire growth stage of bacteria (fermentation). Several very important discoveries were made. For example, the pyrite surface invariably drastically changed its properties at the second day of fermentation. Beyond two days of fermentation, the cyclic voltamograms were insensitive to convective diffusion produced by stirring. The SEM study revealed that bacteria populated the pyrite surface at an extremely high density levels. The high density of bacteria, and the solid reaction products formed on the pyrite surface created conditions for pore diffusion which explained why the CVs became insensitive to convective diffusion in solution (stirring). 14 refs., 22 figs., 2 tabs.

4567 (EGG-M–89194) **Studies on dibenzothiophene degrading bacteria.** Key, D.H.; Willey, M.S.; Kase, R.S.; Ward, T.E. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1989]. 10p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC07-76ID01570. (CONF-890582–3: Biological processing of coal and coal-derived substances, Palo Alto, CA (USA), 16-17 May 1989). Order Number DE90001750. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We are studying the interaction of several bacterial isolates with dibenzothiophene (DBT), a sulfur-containing model compound similar to some of the sulfur-containing components of fossil fuels. The goal is to use these bacteria for microbiological coal desulfurization. Approximately 20 strains that metabolize DBT have been identified using an assay based on the oxidation/reduction indicator dye triphenyltetrazolium chloride (TTC). These isolates possess different types of interactions with DBT, based on the variety of physiological responses observed. The extent to which these isolates degrade DBT under specific conditions has been quantitated, using chloroform extraction of entire cultures followed by gas chromatographic analysis, and ranges from zero to about 60%. Some of the strains have been tentatively identified as Pseudomonas species. Studies of the metabolites produced from DBT by these isolates are in progress. 10 refs., 3 tabs.

4568 (EPRI-GS–6372) **Shell Coal Gasification Project (SCGP-1): Design and construction phase.** Electric Power Research Inst., Palo Alto, CA (USA); Shell Development Co., Houston, TX (USA). c Dec 1989. 69p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report describes the status of the Shell Coal Gasification Project-1, SCGP-1, at startup. This plant will demonstrate Shell's coal gasification technology. The report includes a description of the facilities and photographs and drawings of the plant. Expected plant performance is indicated and the startup coal analysis is given. The overall project status is reported. Additional progress reports will be published as the Shell Coal Gasification Project proceeds. 2 refs., 21 figs., 4 tabs.

4569 (EUR–12066-FR) **Round table meeting 'chemical and physical valorization of coal'.** Commission of the European Communities, Luxembourg (Luxembourg). 1989. 241p. (In English, French or German) (CONF-8812120–: Round table meeting on chemical and physical valorization of coal, Brussels (Belgium), 21 Dec 1988). Available from Commission of the European Communities (Luxembourg).

A total of 9 papers was presented at the meeting. The papers cover the following topics: the behaviour of individual coal constituents in hydrogenation; the hydropyrolysis of low-temperature coal tar fractions; the behaviour of organically-bound sulphur during coal pyrolysis; the behaviour of pitch binders in coking and in the production of carbon electrodes; analysis of pitch; development of a mathematical model of the coking process; the influence of zinc chloride additions on carbonisation; and the behaviour of certain coal mineral matter components during combustion. All the papers have been abstracted separately.

4570 (EUR–12066-FR, pp. 1-31) **Effect of maceral association on coal hydrogenation.** Steller, M. (Bergbau-Forschung GmbH, Essen (Germany, F.R.)). Commission of the European Communities, Brussels (Belgium). 1989. (In German). (CONF-8812120–: Round table meeting on chemical and physical valorization of coal, Brussels (Belgium), 21 Dec 1988). In *Round table meeting 'chemical and physical valorization of coal'*. Order Number DE90724050.

Examines the effect of maceral interstratification on the behaviour of two Ruhr coal types during hydrogenation. The maceral concentrates of each coal sample were mixed together in such a way that the maceral composition represented that of the original coal. The feed coals, maceral concentrates and maceral concentrate mixture were hydrogenated under identical conditions. The feed material and residue were then analysed coal-petrographically and chemically. From the composition of the hydrogenation residue and conversion products it was possible to acquire information on the reactivity of the macerals and on that of the maceral association. In spite of the similar maceral composition or total reflectance distribution of the original and artificially-composed coal samples, differences could be detected in the proportions and composition of the residue. While in the case of the low-volatile coal (sample 2) the maceral association (microlithotypes) seems to have a large influence on the alteration of the macerals, this situation is reversed with the higher-volatile coal (sample 1). In the latter case the 'exposure' of the macerals appears to have a positive effect on the capacity for hydrogenation. As expected, the vitrinite and exinite proved to be highly reactive, providing the largest yield of liquid and gaseous products. The inertinite played a rather secondary role in the hydrogenation process. 7 refs., 12 figs., 6 tabs.

4571 (EUR–12066-FR, pp. 33-57) **Hydrogenative pyrolysis under pressure of a phenolic fraction of a low-temperature tar.** Cypres, R. (Universite Libre de Bruxelles (Belgium). Service de Chimie Generale et Carbochimie); Braekman-Danheux, C.; Progneaux, A.; Englebert, P. Commission of the European Communities, Brussels (Belgium). 1989. (In French). (CONF-8812120–: Round table meeting on chemical and physical valorization of coal, Brussels (Belgium), 21 Dec 1988). In *Round table meeting 'chemical and physical valorization of coal'*. Order Number DE90724050.

Hydrogenative cracking of a phenolic fraction of a low-temperature tar was investigated as a function of pressure, temperature and residence time in order to determine the yield of light aromatic hydrocarbons (BTX) and of phenol and cresols (PC) under the conditions of coal hydrogenative pyrolysis. The results confirm those obtained from model substances and show that cracking of the phenolic fraction produces more than 35% PC at 800 degrees C, 1 MPa and a residence time of 1.2 s, and almost 30% BTX at 800 degrees C, 1 MPa and a residence time of 2.5 s. 7 refs., 6 figs., 7 tabs.

4572 (EUR–12066-FR, pp. 59-81) **Pyrolytic behaviour of heterocyclic sulphur.** Cypres, R. (Universite Libre du Bruxelles (Belgium). Service de Chimie Generale et Carbochimie); Bettens, B.; Hermans, C. Commission of the European Communities, Brussels (Belgium). 1989. (In French). (CONF-8812120–: Round table meeting on chemical and physical valorization of coal, Brussels (Belgium), 21 Dec 1988). In *Round table meeting 'chemical and physical valorization of coal'*. Order Number DE90724050.

The thermal behaviour of benzo(b)thiophene and dibenzothiophene has been investigated with a view to understanding the sulphur retention of the coke at different temperatures and pressures as well as in terms of the carrier gas. Proposes a thermal degradation diagram for the two compounds, whose main stages are as follows: - primary splitting of the benzene sulphur-carbon bond. The presence of hydrogen tends to promote this primary splitting and increase the benzo(b)thiophene cracking rate, though has little effect in the case of dibenzothiophene; - sulphur elimination takes place in the form of H_2S, CS_2, thiophene, heavy sulphur compounds or even by the integration of sulphur in the solid phase. The method of sulphur separation is primarily influenced by the relationship between the pressure of the carrier gas and that of the product being investigated; - the non-sulphur intermediary products obtained after the separation of the sulphur are engaged in most of the reactions leading to the compounds observed in the pyrolysis tests. The effect of the reactive carrier gas, in this case hydrogen, is to destroy these intermediary products and hence prevent the formation of these products; - for the two molecules, a second primary mechanism, which intervenes for about 1% of degradation of the original molecule, must be envisaged to explain the formation of certain compounds observed during the cracking tests. In both cases hydrogen promotes the second primary splitting. 17 refs., 3 figs., 3 tabs.

4573 (EUR–12066-FR, pp. 83-106) **Correlation between the physico-chemical properties of the additives and of copyrolysis coke.** Weber, J.V. (Universite de Metz (France). Laboratoire de Carbochimie et de Synthese Organique); Bertau, R. Commission of the European Communities, Brussels (Belgium). 1989. (In French). (CONF-8812120–: Round table meeting on chemical and physical valorization of coal, Brussels (Belgium), 21 Dec 1988). In *Round table meeting 'chemical and physical valorization of coal'*. Order Number DE90724050.

Presents a method for the classification of copyrolysis additives (coal and petroleum pitch) according to their origins and process of production. This method uses mathematical techniques to investigate the data table for the overall characteristics of the additives and results in a classification based on simple criteria. Describes a method for qualitatively forecasting the optical texture of coke obtained by the copyrolysis of additive and Merlebach coal. Demonstrates that the fluidising properties of the additives (measured by Gieseler plastometer) play a considerable part in the evolution of the coke towards anisotropic textures. Also discusses the role played by the chemical constituents of the additives. 24 refs., 10 figs., 2 tabs.

4574 (EUR–12066-FR, pp. 149-179) **2D coking model allows for gas-steam flow.** Klose, W. (Universitaet Kassel (Germany, F.R.)); Nowack, G. Commission of the European Communities, Brussels (Belgium). 1989. (In German). (CONF-8812120–: Round table meeting on chemical and physical valorization of coal, Brussels (Belgium), 21 Dec 1988). In *Round table meeting 'chemical and physical valorization of coal'*. Order Number DE90724050.

Klose and Vervuert have developed a 2D coking model which disregards convective heat transfer. The model is elaborated, beginning with a description of convective mass transfer in the porous charge. The process employed is as follows: a model is established for gas-steam flow through isotropic, porous media and the pressure loss is determined by the Ergun empirical assumption. The cleavage formation during coking is modelled by the variable arrangement of the pulse-balance boundary conditions. The flow function determined from the pulse balance is used to calculate the pressure and hence the velocity fields of the gases. Permeability is obtained by applying the Darcy equation to the quantities obtained. In order to represent the gas flow in the coke oven, the necessary data are interrogated in the coking model at a suitable moment. The flow of a gaseous mixture of methane and hydrogen is modelled using these values. An attempt is made to determine the permeability from the porosity and pore-radius distribution (bimodal distribution). Pore geometry is modelled with a Bethe network on the basis of Stinchcombe considerations. A flow chart is used to illustrate how the gas flow model ties in with the overall coking model, taking into account a multi-component gas mixture, permeability in the plastic zone and the flow through the fissures in the coke and in the gap between the charge and the oven walls. 6 refs., 17 figs.

4575 (EUR–12066-FR, pp. 181-202) **The addition of a volatile metallic salt to a poorly coking coal influences the material balance of carbonisation.** Jolly, R. (Centre de Pyrolyse de Marienau (France)); Bertau, R. Commission of the European Communities, Brussels (Belgium). 1989. (In French). (CONF-8812120–: Round table meeting on chemical and physical valorization of coal, Brussels (Belgium), 21 Dec 1988). In *Round table meeting 'chemical and physical valorization of coal'*. Order Number DE90724050.

The addition of zinc chloride to Merlebach coal has an effect on the material balance of carbonisation and on the composition of the products. An increase in coke production is accompanied by an increase in hydrogen release and a reduction in that of methane. The plastic properties of the coal are destroyed by the presence of zinc chloride and the resulting coke has a powdery nature. The additive causes a release of hydrogen at low temperature and a dealkylation of the benzol. The action of the zinc chloride is interpreted in chemical terms as an acid catalyst mechanism which superposes itself on the thermal mechanism. 8 refs., 6 figs., 5 tabs.

4576 (FSJ–8901) **Proceeding of the 24th Coal Science Conference 1987.** Fuel Society of Japan, Tokyo (Japan). 1 Oct 1987. 290p. (In Japanese). Order Number DE90724841. Available from NTIS (US Sales Only), PC A13.

73 reports presented in the 24th Coal Science Conference, sponsored by The Fuel Society of Japan in October 1987 at Tokyo, are described. Main subjects are coal liquefaction and coal gasification. Some of them are as follows: activities of various catalysts on hydrogenolysis in coal liquefaction, catalytic activity of sulfate ion, catalyst life, regeneration of catalyst, coal liquefaction characteristics, overall reaction-rate equation in coal liquefaction, sediment and cokes in a coal liquefaction bench plant reactor, gas hold up measurement using a coal liquefaction bench plant, hydrogenation of the solvent for coal liquefaction, swelling and liquefaction of coal, desulfurization and demineralization of coal, chemical structures and properties of coal-derived oil, structures and thermal stabilities of coal liquid residue produced from a brown coal, effect of primary hydrogenation conditions for a brown coal and the thermal behavior of heavy products, characteristics of tars from coal liquefaction residues, catalytic activity of rare earth compounds for the coal gasification, and so on. 189 refs., 266 figs., 141 tabs.

4577 (ORNL/FTR–3472) **[Coal liquefaction and materials]: Foreign trip report, October 29–November 2, 1989.** Judkins, R.R. Oak Ridge National Lab., TN (USA). 17 Nov 1989. 15p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC05-84OR21400. Order Number DE90003200. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this trip was to participate in the AIST-NEDO/DOE-PETC Joint Technical Meeting on Coal Liquefaction, to present three papers at the Joint Technical Meeting on Materials for Coal

Liquefaction, and to serve as an advisor to DOE for establishing an agreement between the US and Japan for the 1990 Implementation Plan Between US DOE and Japan AIST for Materials for Coal Liquefaction. Overall, the trip was very useful in that a great deal was learned about the scope of Japan's research activities on materials for coal liquefaction and about the materials research activities of one of the major steelmaking companies of the world.

4578 (PB–89-227060/XAB) **Environmental Monitoring Plan for the Dow Syngas Project. Annual Health and Safety Report, 1988. Report for 1 April 1988-31 March 1989.** LeBlanc, G. Louisiana Gasification Technology, Inc., Plaquemine, LA (USA). 21 Jul 1989. 806p. Available from NTIS, PC A99.

See also PB–89-227052 and PB–89-227011. Portions of this document are not fully legible.

The Energy Security Act of 1980 established a program to provide financial assistance to private industry in the construction and operation of commercial-scale synthetic-fuels plants. The Dow Syngas Project design is a high-temperature entrained-flow slagging-type gasifier that began operating in 1987. Dow agreed to comply with existing environmental regulations and to develop an Environmental Monitoring Plan (EMP) incorporating supplemental monitoring in areas of potential environmental and health concern, relative to synthetic-fuels facilities. The phases of monitoring in the EMP will test parameters of interest in air, water, and solid waste for evaluating plant operations and for establishing a data base of information for resolving environmental uncertainties relative to replication of synthetic-fuels plants. Details of the industrial-hygiene survey, the Project Safety Program, and the Medical Monitoring Program are given. Personnel-monitoring data for benzene soluble organics, CO, dust, hydrogen sulfide, and noise are described. Data sheets including fugitive-emissions-monitoring results comprise the majority of the report.

4579 (SAND–89-1318C) **Toward understanding photoemission in K + CO coadsorption systems.** Shultz, P.A. Sandia National Labs., Albuquerque, NM (USA). [1989]. 20p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-891093–14: 36. American Vacuum Society national vacuum symposium, Boston, MA (USA), 23-27 Oct 1989). Order Number DE90002577. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Alkali-induced changes in electronic energy levels, observed in photoemission from CO on transition metal surfaces, are examined theoretically and shown to be consistent with the formation of two-dimensional ionic islands in the coadsorbed system. A point charge model is applied to the K + CO system to calculate the levels. The analysis reveals that significant screening of the CO levels, by the extra electron in the K-modified anion, is masked by an equally large electrostatic stabilization of the electrons on the CO site by the Madelung potential (~8 eV) of the $K^+ - CO^-$ layer. The model explains the splitting of the 1π-derived level, by ~1 eV, without requiring any symmetry lowering of the molecular geometry. The results are in reasonable agreement with experimental observations and compare favorably with more sophisticated calculations. 37 refs., 1 fig., 2 tab.

0105 Products and By-Products

Refer also to citation(s) 4913

4580 (EUR–12066-FR, pp. 107-126) **Binders for carbon products: a review of some recent developments.** Sharp, J.A. (Tar Industries Services, Chesterfield (United Kingdom)). Commission of the European Communities, Brussels (Belgium). 1989. (CONF-8812120–: Round table meeting on chemical and physical valorization of coal, Brussels (Belgium), 21 Dec 1988). In *Round table meeting 'chemical and physical valorization of coal'.* Order Number DE90724050.

Traditionally, binders for electrode carbons have been pitches derived from coke-oven tars and their content of approximately 10% of dispersed carbonaceous solids has been regarded by their users as necessary for satisfactory performance. Recent studies with pitches made from by-product tars containing lower levels of insolubles, and with pitches of petroleum origin have shown that satisfactory performance can be obtained in most aspects of the production of prebaked carbons for aluminium cell anodes if small modifications are made to the production process. There remains, however, some doubt about their suitability for the more demanding application in Soderberg self-baking anodes, where the rheology of the unbaked paste of binder pitch and filler coke is of paramount importance. 7 refs., 2 figs., 7 tabs.

4581 (IC–9208) **Gallium and gallium arsenide: Supply, technology and uses.** Kramer, D. Bureau of Mines, Pittsburgh, PA (USA). 1988. 25p. Available from US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

As part of the Nation's growing concern with the competitiveness of U.S. firms in the world economy, especially with respect to advanced materials, the Bureau of Mines assessed the actual and potential recovery and manufacturing capabilities for gallium and gallium arsenide (GaAs). GaAs has advanced from a laboratory curiosity to a material with important high-tech applications within only the last few years, and although protected North American gallium supplies are currently considered adequate, consumption could grow to the point that this assessment would need reevaluation.

0106 Properties and Composition

Refer also to citation(s) 4553, 4570, 4573, 4580, 4639, 4642, 4644, 5545

4582 (ARC–89-02165-3) **Surface characteristics of Canadian coals: porosity, surface area and pore size distribution: Final report.** Alberta Research Council, Edmonton, AB (Canada). Apr 1987. 63p. Ccontract CES 69139-01-SQ. (MICROLOG–89-02165). Available from PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Gas adsorption methods were used to measure surface area, pore volumes, and pore size distribution in 12 samples of Canadian coals. Test procedures, sample preparation, and analysis methods are outlined. Data are presented, based on adsorption data points. 49 figs., 3 tabs.

4583 (ARC/CR–CE-02439) **Proximate and ultimate analysis of coal and products from coal liquefaction and pyrolysis processes.** Murray, C.; Iacchelli, A.; Selucky, M.L. Alberta Research Council, Edmonton, AB (Canada). Coal Research Dept. 1982. 13p. (CONF-8210363–: 14. annual symposium of the Canadian mineral analysts, Thunder Bay (Canada), 19-21 Oct 1982; CE–02439). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: $0.34 CAN per page, $3.40 minimum.

Procedures are given for analysis of coal, coal liquefaction products, and coal pyrolysis products. Proximate analysis (determination of moisture, ash, volatile matter and fixed carbon) using the Fisher Coal Analyzer Model 490, and ultimate analysis (determination of C, H, N, S, O, and occasionally Cl) using the Perkin-Elmer Elemental Analyzer are described. Determination of calorific value of coal using the oxygen bomb calorimeter is also detailed, as well as procedures for trace element analysis and for removal of halogenated solvents from gravity separation fractions of coal. 4 refs., 1 tab.

4584 (ARC/CR–YCLQ-15) **Improvements of instrumental proximate and ultimate analysis of coals and coal conversion products.** Selucky, M.L.; Iacchelli, A.; Murray, C.; Lieshout, T. van. Alberta Research Council, Edmonton, AB (Canada). Coal Research Dept. Jun 1982. 47p. (CE–02435). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: $0.34 CAN per page, $3.40 minimum.

Comparison of proximate analyses obtained using ASTM (American Society for Testing of Materials) methods with those from the Fisher coal analyzer shows that the analyzer gives consistently low moisture and ash values, and high volatile matter values. While the accuracy of moisture and ash determinations can be improved by introducing various instrument and crucible modifications, volatile matter values are less accurate, mainly because of differences in

heating rates. However, reproducibility of results is very good and, with modifications, the instrument can be used to advantage for internal purposes, chiefly because of its large sample capacity. In ultimate analysis of coals using the Perkin-Elmer element analyzer, the main problem is that the initial purge gas flushing period after sample introduction partially removes water from the sample. Various methods of sample drying have shown that the best approach is to dry the sample directly in the instrument at the temperature used for moisture determination; with this modification of the analytical cycle, excellent reproducibility and correlation with the ASTM method have been achieved. The proximate and ultimate analysis of samples of extracts and extract residue are impaired by the presence of residual solvent. The samples can contain up to 10% residual solvent which appear as moisture in the proximate analysis. The report describes several ways of removing the solvent so that accurate analysis can be obtained. The foregoing modifications to procedures and equipment have considerably improved both accuracy and reliability of results obtained by instrumental methods. In consequence, considerably more samples can be handled than by using ASTM standard procedures. 4 refs., 1 figs., 19 tabs.

4585 (DOE/PC/79914–T9) **Macromolecular coal structure as revealed by novel diffusion tests: Annual technical report, September 15, 1988–September 14, 1989.** Peppas, N.A.; Olivares, J.; Drummond, R. Purdue Univ., Lafayette, IN (USA). School of Chemical Engineering. [1989]. 53p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-87PC79914. Order Number DE90003313. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Experimental studies are reported of diffusion in thin sections of various samples. Data are presented of the transport of methylene chloride, chloroform, pyridine, methyl ethyl ketone, toluene, benzene, methanol, acetone and cyclohexane in coals PSOC 418, 853, and 384. The results are analyzed in terms of solubility parameters and the polar contribution to the solubility. These results are compared to swelling of some of crosslinked poly(methyl methacrylate) by some of these solvents. We have proceeded with a more detailed investigation of the influence of various amines on the transport behavior. Finally, we examine various implications of the mathematical analysis using the diffusion/relaxation model. 2 refs., 34 figs., 4 tabs.

4586 (EUR–12066-FR, pp. 127-147) **Extrography - a technique for the separation and analysis of pitch.** Souffrey, B. (Centre de Pyrolyse de Marienau (France)). Commission of the European Communities, Brussels (Belgium). 1989. (In French). (CONF-8812120–: Round table meeting on chemical and physical valorization of coal, Brussels (Belgium), 21 Dec 1988). In *Round table meeting 'chemical and physical valorization of coal'.* Order Number DE90724050.

Extrography improves upon tried and tested methods of selective extraction by combining the effects of extraction and chromatography. It represents a new approach to the fine characterisation of the chemical structure of pitch. The experimental protocol, which has been adapted, was developed in the course of earlier work on coal extracts. The method has now been set up on a CPM routine. The reproducibility is in the order of +/- 2%. The results show that it is possible to differentiate not only between different types of pitch but also between those considered to be 'identical' by conventional methods of classification and customer specifications. The next stage involves linking the extrography histograms for each type of pitch to its usage values in different applications. 7 refs., 7 figs., 7 tabs.

4587 (INIS-BR–1763) **Feasibility study of direct analysis of coal and coke inorganic components by X-ray fluorescence spectroscopy.** Valadares, A.F.; Salgado, J.E.; Castro, J.R.; Pretti, L.G.; Castro Rodrigues, W. de. Associacao Brasileira de Metais, Sao Paulo, SP (Brazil). 1987. 11p. (In Portuguese). (CONF-8705394–: 4. seminar of chemical control in metallurgy, Belo Horizonte (Brazil), 25-27 May 1987). Order Number DE90608986. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The efficiency of an analysis process for coal and coke inorganic components by X-ray fluorescent spectroscopy is tested. The graphics and results are shown, concluding that this methodology can be used for regular attendments. (C.G.C.).

4588 (PDE–89-02165-2) **Petrographic characterization of treated and untreated coals: Final report.** Pearson (D.E.) and Associates Ltd., Victoria, BC (Canada). May 1987. 69p. Contract CES 69139-01-SQ. (MICROLOG–89-02165). Available from PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Twelve coal samples, representing a suite of four high volatile coals both in natural condition and after treatment with various amounts of ferrous sulfate, were characterized by microscopic analysis. Results of all analyses are presented in detail, including data on reflectance, macerals, fluorescence properties, and predicted coal properties. Samples were pelletized, ground and polished under isopropanol. Careful examination of high resolution photomicrographs revealed no traces of the ferrous sulfate. The absence, or inability to recognize, the compound is felt to be due to one or all of the following reasons: sulfate deposition in the form of particles too small for the resolution of the microscope used; disappearance of the sulfate during polishing; and the possibility that the sulfate may have had the same refractive index as the immersion oil used in microscopic examination, thus making the sulfate invisible. 44 figs., 21 tabs.

0108 Waste Management

Refer also to citation(s) 4556, 4560, 4561, 4625, 4626, 4628, 4640, 4643, 4982, 4986, 4987, 4988, 5372, 5845

4589 (CMRC–8902) **Proceeding of the 10th presentation meeting on coal utilization technology 1988.** Coal Mining Research Centre, Tokyo (Japan). Aug 1988. 408p. (In Japanese). Order Number DE90725042. Available from NTIS (US Sales Only), PC A18/MF A01.

Twenty two reports on coal utilization technology are compiled. The reports were presented in the 10th meeting on coal utilization technology, sponsored by The Coal Mining Research Centre, Japan in August 1988. The studies are divided broadly into three categories such as utilization of the fly ashes, coal combustion technology and coal-water mixture (CWM). Some of them are as follows: recovery of valuable matters from coal fly ashes, experimental test in construction material application of coal fly ashes produced by boilers in general industries, underwater molding technology of artificial reef using fly ashes, fluidized bed cement calcining system, coal ashes utilization technique by hydrothermal reactions, Wakamatsu 50MW fluidized bed boiler demonstration test, coal partial combustor, measurement of burnout and NOx emission in a pulverized coal combustion, low calorific coal gasification combined power generation, pressurized fluidized bed combustion combined cycle, static electricity noticed while CCS coal dust transportation, conversion of existing oil-firing boiler for industrial use to low-ash CWM firing, coal-water mixture (CWM) demonstration test for general industrial use in medium and small size boilers, and so on. 106 refs., 290 figs., 145 tabs.

4590 (CONF-881143–8) **Effective sorbent mixing in a simulated entrained-flow coal reactor: A coal flow study.** Braithwaite, D.J.; Hedman, P.O. Brigham Young Univ., Provo, UT (USA). Combustion Lab. [1988]. 16p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC21-86MC23075. From American Institute of Chemical Engineers annual meeting; Washington, DC (USA); 27 Nov - 2 dec 1988. Order Number DE90002928. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The injection of sorbent particles into an entrained-flow coal reactor was simulated by the injection of a jet normal to a fully developed air flow. Effects investigated were the free stream Reynolds number, jet size and velocity, and number of jets. Test techniques included smoke injection for flow visualization, tracer gas extraction, and laser-Doppler velocity measurements. The results showed that the trajectory of a jet in cross flow is dependent on the jet to main flow momentum ratio, as well as the size of the jet. Buoyancy played an important role in jet behavior at low free stream Reynolds numbers. Greater turbulence intensity and enhanced mixing occurred when the jet momentum was sufficient to cause the jet to impinge on the opposing wall or another jet. 13 refs., 9 figs.

4591 (DOE/PC/79798–T6) **LIMB Demonstration Project Extension: Quarterly report No. 9, May–July 1989.** Babcock and Wilcox Co., Barberton, OH (USA). Contract Research Div. 15 Aug 1989. 19p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC22-87PC79798. Order Number DE90002758. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The subject of this report is progress during the quarter for Phase I – Design and Permitting, Phase II – Coolside/LIMB Construction, Start-Up and Phase III – Operation, Data Collection, Reporting and Disposition. Under Phase I, Task 2, Consol Technology Transfer, Consol R & D continued to review the status of the Coolside installation and identified construction details which required additional action. Activities in Task 4.0 – Permitting and Licensing have focused on finalizing a subcontract agreement for trucking the DOE Coolside/LIMB ash to a solid waste landfill. Under Phase II, Task 1, Project Management, purchase orders were placed with two (2) lime suppliers for supplying the specified hydrated lime to be used for the Coolside test program. For Subtask 2.2 – Sorbent Feed System Installation, the construction and installation of the sorbent feed system has been completed. Under Phase III, Subtask 2.1, Optimization of the Coolside sorbent feed system, the ash recycle system and the caustic injection system were initiated. 3 figs.

4592 (IEACR–18) **Market impacts of sulphur control: The consequences for coal.** Vernon, J.L. IEA Coal Research, London (UK). c Oct 1989. 109p. Sponsored by International Energy Agency. Available from IEA Coal Research, 14-15 Lower Grosvenor Place, London, SW 1W OEX, England.

The report is organized in two parts. The first part provides an overview of SO_2 control strategies in major coal-using countries, and assesses the implications of these strategies for the use of existing coal-fired plants and for investment in control equipment, investment in new coal combustion technologies, and fuel choice. The second part of the report comprises a series of annexes describing in more detail the SO_2 control strategy of each country and its impacts on coal use within that country. 106 refs., 6 figs., 28 tabs.

4593 (PB–89-236376/XAB) **Calcium oxide sintering in atmospheres containing water and carbon dioxide.** Borgwardt, R.H. Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab. 1989. 10p. (EPA–600/J-89/009). Available from NTIS, PC A02/MF A01.

Pub. in Ind. Eng. Chem. Res., Vol. 28, No. 4, 493-500(Apr 1989).

This paper gives results of measurements of the effects of water vapor and CO_2 on the sintering rate of nascent CaO, as a function of partial pressure and temperature using CaO prepared by rapid decomposition of $CaCO_3$ and $CA(OH)_2$. Each gas strongly catalyzed the sintering process and their combined effects were additive. A model formulated by R. M. German and Z. A. Munir in 1976, which describes surface area reduction by a single mechanism, is empirically modified to account for catalytic effects of the gas phase. Although multiple sintering mechanisms are apparently operative in the presence of CO_2 and/or H_2O, the empirical model correlates isothermal surface area reduction as a function of time over the temperature range of 380 to 1150 C and partial pressures of 39 Pa to 15 kPa. Porosity reduction was also accelerated by the presence of H_2O or CO_2 in the sintering atmosphere. In an atmosphere of simulated flue gas, porosity reduction followed the Coble logarithmic law during sintering at 800, 900, and 1000 C with induction periods of 6, 4.5, and 2.7 sec, respectively, for onset of particle shrinkage. Coupling the sintering model with a sulfation model that accounts for the effects of surface area allows the prediction of SO_2 capture efficiencies in boiler furnaces by $Ca(OH)_2$ injection.

4594 (PB–89-236384/XAB) **Structural changes in surfactant-modified sorbents during furnace injection.** Kirchgessner, D.A.; Jozewicz, W. Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab. Mar 1989. 9p. (EPA–600/J-89/008). Available from NTIS, PC A02/MF A01.

Pub. in American Institute of Chemical Engineers Jnl., Vol. 35, No. 3, 500-506(Mar 1989).

This paper discusses a calcium hydroxide ($Ca(OH)_2$) sorbent, modified by the addition of calcium lignosulfonate, that was recently developed for use in EPA's LIMB (limestone injection multistage burners) process. The increased reactivity with sulfur dioxide (SO_2) displayed by this modified sorbent has been shown to be caused, in part, by its decreased particle (agglomerate) size compared to conventional $Ca(OH)_2$. Subsequent work has shown that surfactant-modified $Ca(OH)_2$ also undergoes significantly different structural changes during furnace injection. For a given reactor temperature and residence time, the modified sorbent calcines to a greater extent that unmodified sorbent. It also loses surface area more slowly, and retains more of its porosity, suggesting that it sinters more slowly than conventional sorbent. Therefore, in addition to reducing the particle size of $Ca(OH)_2$ in some applications, calcium lignosulfonate also appears to cause the water of hydration to be bound less tightly, and to inhibit one or more of the diffusion mechanisms responsible for the process of sintering.

4595 (PB–89-236400/XAB) **Sintering of nascent calcium oxide.** Borgwardt, R.H. Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab. 1989. 10p. (EPA–600/J-89/006). Available from NTIS, PC A02/MF A01.

Pub. in Chemical Engineering Science, Vol. 44, No. 1, 53-60(1989).

The paper discusses the measurement of the sintering rate of CaO in a nitrogen atmosphere at temperatures of 700-1100 C. CaO prepared from ultrapure $CaCO_3$ was compared with an impure CaO derived from limestone. Both materials yielded an initial surface area of 104 sq m/g. The rate of surface reduction was independent of particle size between 2 and 20 micrometers, but strongly dependent on temperature and impurities. A model was used to correlate the kinetics of surface reduction and identify lattice diffusion as the mechanisms of solid transport. Impurities increased the rate of sintering at a given temperature and reduced the activation energy. The porosity declined logarithmically with time during the intermediate stage of sintering.

4596 (PB–89-872451/XAB) **Sulfur dioxide control: Sulfur dioxide from coal-burning sources. May 1986-September 1989 (Citations from the NTIS database). Report for May 1986-September 1989.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 63p. Available from NTISPC N01/MF N01.

See also PB–89-872469.

This bibliography contains citations concerning air pollution control technology and various means for desulfurization of coal-combustion streams. These means include fluidized-bed and other combustion modifications, and the removal of sulfur dioxide from flue gas. Proper monitoring of the effluent to meet the established atmospheric standards is also discussed. Applications in power plants, steam boilers, furnaces, kilns, and gas turbines are presented. (Contains 90 citations fully indexed and including a title list.)

4597 (RRTAC–89-2, pp. 117-126) **Hollow fill construction at the Amos Ridge experimental practice.** Zipper, C.E. (Virginia Polytechnic Institute and State University, Blacksburg (USA). Dept. of Crop and Soil Environmental Science); Daniels, W.L. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume I.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

Between January 1984, and October 1988, the Amos Ridge Coal Company performed contour surface mining operations in steeply-sloping terrain under an experimental practice variance from the requirements of SMCRA, as implemented by the Virginia Coal Surface Mining Regulations. The objective of the experimental practice was to investigate the feasibility of experimental spoil handling practices. All environmental performance standards of SMCRA were met, with the exception of those regulations dealing with the construction of hollow fills and the restoration of approximate original contour. Three different hollow fill construction methods were used; one conforming to OSMRE and Virginia regulations, and two using experimental techniques. An intensive data collection program documented economic, operational, and environmental consequences of the mining and reclamation procedures utilized. The results indicate

that spoil was handled in a cost-effective and environmentally sound fashion, in spite of departure from procedures specified by SMCRA. Analysis of costs of constructing hollow fills indicates distinct differences in the per-cubic-yard costs of spoil disposal among the three fill designs utilized. An experimental hollow fill design, using a rock core chimney drain, appeared to be more cost effective than either of the other two fill designs. However, elapsed time since completion of the fills is not sufficient to compare long-term environmental impacts. 6 refs., 6 figs., 2 tabs.

4598 (RRTAC–89-2, pp. 517-522) **Improvement of fly-ash reclamation with organic, organo-mineral and mineral amendments.** Insam, H. (Institute for Soil Biology, Braunschweig (Germany, F.R.)). Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume II.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

Fly-ash deposits are usually difficult to reclaim due to poor chemical and physical properties. Using different kinds of composts, organic amendments, soil conditioners, and mineral fertilizer a reclamation trial was established on an ash-dump in the Helmstedt mining area (FRG). Vitality of the grasses sown, as well as the percent plant cover were highest on the plots amended with Ferihum^R (bark compost) and Biosol^R, a product of fungal mycellium. If these organic amendments were supplemented by 0A^R, an organo-mineral complex, vitality and plant cover were improved. Microbial activity (arginine-ammonification rate) and biomass were highest on the compost plots, and lowest on those that had not received organic amendments. Supplementation with ACS^R increased microbial biomass levels. The positive effects of Biosol^R, ACS^R, and Ferihum^R, or combinations thereof, may have been due to a reduction of pH or salt concentrations in the soil solution, or an improved physical stability due to the formation of stable aggregates. 10 refs.

4599 (RRTAC–89-2, pp. 673-680) **Microbial sulfate reduction for the treatment of acid mine drainage: a laboratory study.** Hammack, R.W. (US Bureau of Mines, Pittsburgh, PA (USA). Pittsburgh Research Center); Hedin, R.S. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume II.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

A laboratory study was conducted to determine if sulfate-reducing ecosystems can effectively treat acid mine drainage in the presence and absence of calcareous substrates. Four anaerobic mesocosms (20 L) were created in the laboratory by inundating carboys containing spent mushroom compost and allowing native fermentative organisms and sulfate-reducing bacteria to become established. The mushroom compost in two carboys was underlain by calcareous gravel; the other two carboys contained a noncalcareous gravel substrate. Simulated acid mine drainage was passed through each carboy and samples of the inflow and outflow were analyzed to determine pH, acidity, alkalinity, and concentrations of iron, manganese, sulfate, and calcium. At influent pH 4-5, about 90 pct of the iron and 80 pct of the manganese were removed with a single pass through the mesocosms. At influent pH 2.5-3.5, about 80 pct of the iron and 50 pct of the manganese were removed. About 55 pct of the sulfate was removed irrespective of influent pH. All effluent from the mesocosms exhibited a circumeutral pH and had slight net alkalinity. The presence or absence of a calcareous substrate did not significantly affect the pH and alkalinity of the effluents or the quantity of iron and sulfate removed. However, mesocosms with calcareous substrates were more effective in removing manganese. Results of this study indicate that existing anaerobic organisms will remain active in the presence of acid mine drainage and significantly improve water quality. 6 refs., 9 figs., 1 tab.

4600 (RRTAC–89-2, pp. 607-616) **Physical and chemical characersitics of coal prep plant wastes from southwest Virginia.** Stewarts, B.R. (Virginia Polytechnic Institute and State University, Blacksburg (USA). Dept. of Crop and Soil Environmental Sciences); Daniels, W.L. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume II.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

Coal prep plant wastes are difficult to reclaim due to high potential acidity and coarse fragment content, low water holding capacity, lower fertility, and othe problems. Little is known about their properties, particularly as they relate to revegetation potential. This study was undertaken to determine the physical and chemical properties of composite samples from 27 coal waste piles of varying age. Selected physical and chemical properties varied widely across this sample set. The pH values varied from 8.3 to 3.0, and the older piles had lower pH values than the more recent piles. Base saturations ranged from 100% to 1% and, as expected, were highly correlated with pH values. The saturated paste electrical conductivity (EC) was higher in the younger coal waste materials. The mean coarse fragment (>2mm) content of these materials was 60%. The average texture of the fine (<2mm) fraction was a sandy loam with 15% clay. The mean water retention difference, between 10.0 J kg^{-1} and 1500 J kg^{-1} of soil moisture tension, in the fine fraction was 0.136 g water/g soil. These moisture retention values are very low when compared with those of natural soils, particularly in light of the wastes' high coarse fragment content. Double acid extractable P was generally low, but a few samples had high levels of P. The results indicate that some low-S refuse materials would be suitable for direct seeding, but serious water holding and long term nutrient availability problems are likely. 17 refs., 1 fig., 4 tabs.

4601 (RRTAC–89-2, pp. 707-716) **Overview of tailings reclamation in western Canada.** Ziemkiewicz, P.F. (West Virginia University, Morgantown (USA). National Mined Land Reclamation Center); Gallinger, R. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume II.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

Coal, oil sands, potash, precious and base metals are mined in western Canada. Each produces its characteristic type of tailings. Reclamation is controlled by local regulatory requirements and by the nature of the tailings and adjacent land uses. The tailings range from innocuous to highly reactive; posing short term revegetation concerns to indefinite maintenance problems. Major, unresolved technical problems occur with oil sand tailings and sulfide metal mine tailings.

0109 Environmental Aspects

Refer also to citation(s) 4578, 4597, 4598, 4599, 5824, 5826, 5844, 5845

4602 (CONF-891080–1) **Global climate change: A fossil energy perspective.** Kane, R. (USDOE, Washington, DC (USA)); South, D.W. Argonne National Lab., IL (USA). [1989]. 7p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. From 6. international coal trade, transportation and handling conference: Coal Trans '89; London (UK); 16-18 Oct 1989. Order Number DE90003770. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Global climate change has attracted considerable attention recently as an emerging environmental problem. While substantial uncertainties still exist regarding the ability to accurately predict climate change, some scientists and policymakers believe immediate action is required. As a result, legislative proposals have been introduced and policies/programs proposed to address the perceived

problem. Since fossil fuel combustion has been identified as a major contributor to the growth in atmospheric greenhouse gases, curtailing the emissions from fossil-fired facilities is a primary focus of many proposals. This paper discusses global climate change from a fossil, energy development and utilization perspective and demonstrates that if it is determined that greenhouse gas emissions should be reduced, fossil fuels and fossil-fuel-based technologies can, and must, play a role. 24 refs., 7 figs., 1 tab.

4603 (RRTAC–89-2, pp. 49-58) **The impact of climate on reclamation success in the foothills/mountains region of Alberta, Canada.** Macyk, T.M. (Alberta Research Council, Edmonton (Canada). Terrain Sciences Dept.); Widtman, Z.W.; Betts, V. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume I.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

The Alberta Research Council has conducted a reclamation research program near Grande Cache, Alberta in conjunction with the surface mining operations of Smoky River Coal Limited since 1972. Use of appropriate materials handling techniques and selection of suitable plant species combined with good management practices has resulted in the establishment of diverse plant communities that allow for different land use options. Climate was recognized as the most limiting factor to reclamation success in the region. Precipitation records were maintained on a growing season basis since the inception of the program. More recently, continuous monitoring equipment was installed to measure precipitation, air and soil temperature, wind speed and direction and relative humidity on a continuous basis. Frost-free period has ranged from 45 days to 112 days during the last five years. Soil temperatures at the 1 cm depth were found to exceed 46 degrees C for several hours on consecutive days in areas characterized by a grass and legume cover. Measurement of the distribution and intensity of precipitation events indicates that the distribution of moisture can be somewhat less than effective for good plant establishment and growth. Prevailing winds are from the west and south. The data collected in the monitoring program are used to develop and refine operational reclamation procedures used in the area. 4 refs., 3 figs., 6 tabs.

4604 (RRTAC–89-2, pp. 101-106) **Reclamation challenges at Usibelli coal mine in Healy, Alaska.** Jackson, L.P. (Usibelli Coal Mines, Inc., Healy, AK (USA)). Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume I.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

Reclamation in a subarctic environment requires a thorough understanding of the effect of subzero temperatures on soil, water and vegetation. Usibelli Coal Mine's Poker Flats mine is located in an area that contains zones of permafrost. The presence of permafrost requires study due to the fact that once it is disturbed it will eventually thaw. The type of material the permafrost is comprised of determines the options in stabilizing and maintaining vegetation on it. Once an analysis of soil conditions is conducted, a more detailed study is done to determine water control measures to be considered given the presence of frozen, ice-rich ground. The water control measures to be implemented are usually untested in the field. This leads to both pleasant and unpleasant results. The water control plan incorporates erosion control measures. Erosion control is one of the most challenging aspects of reclamation in the Healy area, as the Hoseanna (Lignite) Creek drainage has one of the highest rates of natural erosion in the world. One of the key components of maintaining a successful reclamation program in Alaska is to not have any preconceived idea of what is going to happen next. Each project that is designed and implemented usually involves procedures that have never been tried in this particular environment. Because there is little or no precedent for these types of projects, every day is an adventure. 3 refs., 3 tabs.

4605 (RRTAC–89-2, pp. 127-135) **Moose and deer habitat use and diet on a reclaimed mine in west-central Alberta.** Roe, N.A. (Nicholas Roe & Associates Ltd., Calgary, Alberta (Canada)); Kennedy, A.J. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume I.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

Moose (Alces alces) and deer (Odocoileus spp.) use of a reclaimed coal test mine site and adjacent habitat in west-central Alberta was monitored to determine habitat use, use of plant shrubs, and diets. In 1979, the site was seeded with grasses, alfalfa (Medicago sativa) and clover (Trifolium sp.), then planted with lodgepole pine (Pinus contorta) and white spruce (Picea glauca) seedlings, and willow (Salix pedicularis). Mean levels of use by moose and deer of the site were higher than in adjacent habitat, not significantly by moose ($p>0.05$), significantly by deer ($0.05<p<0.10$). Use of the site was variable from year to year, with no clear trend; variability was less in adjacent habitats. Days-of-use/ha of the site by deer was twice that of moose, but the difference was not significant on a year-by-year basis. Moose diet was primarily willow (88%) and spruce (8%); deer diet was primarily Cornus (31%), legumes (23%), Equisetum (15%), and Populus (6%). Planted willow shrubs were heavily or moderately browsed between 1981 and 1985. Seeded grasses were sparingly grazed. 15 refs., 1 figs. 3 tabs.

4606 (RRTAC–89-2, pp. 141-149) **Seasonal and spatial distribution of bighorn sheep at an open pit coal mine in the Alberta foothills.** MacCallum, B. (University of Calgary, Alberta (Canada). Faculty of Environmental Design). Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume I.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

Mining activity at Cardinal River Coals Ltd., an open pit mining site in the Alberta foothills, drastically changed the landscape from a closed canopy coniferous forest to open terrain consisting of reclaimed meadows in proximity to unreclaimed pit walls. A population of approximately 200 bighorn sheep which had been using the mine lease was studied during the year 1985-86. Ranges for the prerut, rut, winter and spring seasons were variously located on the lease area, as well as features such as lambing walls and mineral lick sites. Highwalls of exhausted pits were used for escape terrain and travel routes. Recommendations were made to the Alberta Land Conservation and Reclamation Council regarding maintenance of highwalls in association with reclaimed meadows as integral components of bighorn sheep habitat. This site-specific wildlife study should be invaluable for mine planning and reclamation efforts. 9 refs., 1 fig.

4607 (RRTAC–89-2, pp. 151-156) **The creation of a mountain lake sportfishery at Cardinal River Coals Ltd.** Acott, G.B. (Cardinal River Coals Ltd., Hinton, Alberta (Canada)). Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume I.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

Cardinal River Coals, Ltd. produces 2 million clean short tons of metallurgical grade coking coal annually for the export market. The primary focus of reclamation at CRC, Ltd. is the development of wildlife habitat with particular emphasis on Rocky Mountain Bighorn Sheep. A secondary objective of recreational development has been applied in our 50-B-6 Area with the creation of a lake. Shoreline recontouring, littoral zone construction, macrophyte/plankton

innoculation and habitat enhancement techniques have been utilized in an attempt to provide a viable sportfishery. Progress to date is being monitored by a continuing limnological study to determine rate of food chain development leading to recommendations for a sportfish stocking program. 3 refs.

4608 (RRTAC–89-2, pp. 175-184) **Grazing demonstration on reclaimed lands at the Black Thunder Mine, Campbell County, Wyoming.** Moore, R.L. Jr. (Thunder Basin Coal Co., Wright, WY (USA)); Keammerer, W.R.; De Puit, E.J. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume I.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

One of the standards of reclamation success is demonstrating the ability of the reclaimed plant community to sustain grazing pressure by domestic livestock and native wildlife that is at least equal to premining grazing pressure. Five to seven year old reclaimed areas at the Black Thunder Mine were utilized in designing and constructing a two pasture rotational grazing system that encompasses a total of 74 hectares. The study design includes vegetation monitoring to document forage utilization and determine changes in vegetation due to grazing, and livestock weighing to determine animal performance while grazing mined land vegetation. In 1988, the first year of the study, Black Angus-Hereford cross (black-baldy) yearling steers were introduced to the west pasture in mid-May. The cattle were moved into the east pasture in mid-July where they remained until mid-September. Vegetation data were collected in mid-July and again in mid-September to provide baseline pasture vegetation characteristics and forage utilization data. First season results indicated excellent animal performance under 60-70% forage utilization, with average daily gains of 1.03 and 0.60 kilograms/animal/day during early and late rotations, respectively, and an average gain of 0.83 kilograms/animal/day season-long. Vegetation responses to grazing will be determined after post-grazing sampling in 1989 and 1990. 16 refs., 1 fig., 5 tabs.

4609 (RRTAC–89-2, pp. 185-198) **Complementary grazing of reclaimed mined land and native rangeland pastures in Montana.** De Puit, E.J. (Univ. of Wyoming, Laramie (USA). Dept. of Range Management); Coenenberg, J.G. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume I.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

A three year grazing study was conducted on Montana coal-mined lands revegetated with introduced, cool-season grasses and legumes. Objectives were to determine responses of mined land revegetation and soils to livestock (cattle) grazing, and to evaluate the capability of mined land vegetation to support livestock under two rotational grazing systems: exclusive grazing of mined land pastures season-long, and complementary mined land-native rangeland grazing. Spring and late summer grazing improved productivity of mined land vegetation, induced certain changes in plant species composition and diversity, and positively influenced certain soil attributes. Forage quality and animal gain data demonstrated highest utility of the introduced plant species for spring grazing, and lower value during the summer when animal performance on native range pastures was superior to that on mined land pastures. Total spring through summer cattle gains were higher with the complementary mined land-native rangeland grazing system than with the exclusive mined land system, although exclusive grazing of mined land vegetation produced acceptable season-long cattle gains. 31 refs., 1 fig., 4 tabs.

4610 (RRTAC–89-2, pp. 255-262) **Promising native forbs for seeding on mine spoils.** Bjugstad, A.J. (USDA Forest Service, Rapid City, SD (USA). Rocky Mountain Forest and Range Experiment Station); Whitman, W.C. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume I.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

Twenty nine species of perennial forbs and 2 biennial forbs were directly seeded into coal mine spoil materials at Dickinson, North Dakota to determine which species would be most successful for direct seeding into coal mine spoil. Those which showed exceptionally good emergence and vigourous growth of seedlings in a two year study were: white prairie clover (Petalostemum candidum), wild licorice (Glycyrrhiza lepidota), prairie coneflower (Ratibida columnifera), blazing star (Liatris punctata) and long-leaved milkvetch (Astragalus ceramicus). Species with lesser but acceptable germination only were: white upland aster (Aster ptermicoides), purple coneflower (Echinacea angustifolia), early goldenrod (Solidago missouriensis), green milkvetch (Astragalus striatus), purple prairie-clover (Petalstemum purpureum) and evening star (Metzelia decapetala). Other species tested showed little to no germination and hence are difficult to establish by direct seeding into coal mine spoil. 19 refs., 5 tabs.

4611 (RRTAC–89-2, pp. 209-218) **Groundwater hydrologic regimes within reclaimed surface coal mined landscapes in Alberta.** Moran, S.R. (Alberta Research Council, Edmonton (Canada)); Trudell, M.R.; Macyk, T.M. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume I.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

Between 1979 and 1988, the Plains Hydrology and Reclamation Project (PHRP) investigated interactions of groundwater, soils, and geology and successful reclamation of surface coal mines in the plains of Alberta. One of the objectives of the study was to document the processes by which a steady-state hydrological regime was re-established following reclamation and to determine the rate at which steady-state conditions were attained. Instrumentation was installed in spoil at two study areas: the Battle River area, which included Diplomat, Vesta and Paintearth Mines, and the Wabamun area, which included the Highvale and Whitewood Mines. The work demonstrated that the processes by which water enters the spoil and the rate at which the post-reclamation steady-state equilibrium hydrologic regime is established differ both within and between mine sites depending on the hydraulic conductivity of the spoil and the landscape setting within the reclaimed terrain. In lowland settings at mines characterized by high permeability spoil, steady-state equilibrium conditions are established within 5 to 10 years of regrading. In upland settings at mines characterized by low permeability spoil, on the other hand, many decades are required to established steady-state equilibrium conditions. 10 refs., 3 figs., 1 tab.

4612 (RRTAC–89-2, pp. 219-228) **Geomorphic responses of natural and reclaimed hillslopes to precipitation events in Wyoming.** Toy, T.T. (University of Denver, CO (USA)). Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume I.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

Runoff and sediment data were collected from plots on two natural and reclaimed hill slopes at the Glenrock Coal Company. Runoff from the newly reclaimed site exceeded that from the natural sites despite lower average precipitation intensities; however, runoff from the older reclaimed site was less than from the natural sites. Sediment yield from the newly reclaimed site was much higher than from the natural sites while sediment yield from the older reclaimed site was within the range of that from the natural sites. Sediment concentrations of flows from the newly reclaimed site were very

high, especially at the beginning of the record, and greatly exceeded those from the natural sites. Again, sediment concentrations from the older reclaimed site were within the range of those from the natural sites. There were significant statistical relations between runoff and sediment yield. The comparison of sediment and soil particle-size distributions suggested selective entrainment and transportation of soil separates. Lastly, available evidence suggested that reclaimed surfaces may approach a semblance of equilibrium, analogous to natural surfaces, in above five years. 19 refs., 3 tabs.

4613 (RRTAC–89-2, pp. 239-245) **Agricultural capability of surface-mined land in east-central Alberta.** Moran, S.R. (Alberta Research Council, Edmonton (Canada). Terrain Sciences Dept.); Trudell, M.R.; Macyk, T.M.; Cheel, D.B.; Howard, A. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume I.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

Between 1979 and 1988, The Plains Hydrology and Reclamation Project (PHRP) studied the impacts of surface coal mining in the plains of Alberta on the agricultural capability and hydrology of reclaimed landscapes. The agricultural capability of reconstructed soil landscapes is generally equivalent to, although less variable than, that of unmined landscapes. Physical and chemical properties of well drained reconstructed soils are improved through downward leaching of sodium and a decrease in bulk density. Surface wetness and soil salinity result in degradation of capability in small areas of reclaimed sites. The most important hydrologic impact of surface mining is removal of the shallow aquifers that provide the majority of agricultural water supplies. In some areas, replacement water supplies are available from beneath the base of mining. Chemical quality of groundwater in mine spoil is significantly degraded relative to that in pre-existing coal aquifers. Surface mining has essentially no impact on water quality outside of mined areas. 11 refs., 2 figs.

4614 (RRTAC–89-2, pp. 289-298) **Response of reseeded coal mine spoils to season and intensity of defoliation: preliminary findings.** Wolters, G.L. (Rocky Mountain Forest and Range Experiment Station, Albuquerque, NM (USA)); Aldon, E.F.; Donart, G.B. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume I.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

Two principal questions facing managers of revegetated coal mine spoils in the semiarid Southwest are how seasonal defoliation patterns and intensities of defoliation affect forage production and plant stability on reclaimed sites. Preliminary findings were obtained from a study conducted on revegetated coal mine spoils near Gallup, NM, during 1982-1984. Five mine spoil sites, recontoured and seeded to a mixture of predominantly wheatgrasses (Agropyron spp.) between 1975 and 1980, were selected for study. Each site was subdivided into six split plots that were randomly assigned defoliation seasons of early spring, late spring, summer, fall, winter or a control. All plots except the control were subdivided and were assigned defoliation intensities of 7.5 cm or 15 cm. Defoliation treatments were applied two consecutive calendar years, early spring 1982 to winter 1984. Treatment effects were assessed in late August 1984. Preliminary findings indicate neither wheatgrasses nor total standing herbage was influenced by seasonal defoliation, but other grasses were less productive when defoliated in the summer and winter than when defoliated in the fall. Total herbage production diminished when defoliated at the 7.5-cm stubble height every season except early spring and fall compared to the control. Generally, defoliation at 15 cm did not impact total herbage production. Neither the time since seeding of the coal mine spoils nor topsoiling consistently influenced total herbage production. 21 refs., 3 tabs.

4615 (RRTAC–89-2, pp. 299-307) **Utilizing the Rhizobium-subterranean clover association for reclamation of lignite mine spoil.** Harris, P.A. (Texas A & M University, College Station (USA)); Zuberer, D.A. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume I.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

Field plots were established on freshly-levelled lignite mine spoil at Big Brown Mine near Fairfield, Texas, in the fall of 1986 to study the effects of fertilization and inoculation with Rhizobium leguminosarum biovar trifolii on the establishment and growth of subterranean clover (Trifolium subterraneum L.), to evaluate the survival of Rhizobium in mine spoil, and to examine the effect of clover presence on yields of subsequent coastal bermudagrass (Cynodon dactylon L.) crops. In 1987, clover yields were greatest in inoculated plots with added P and K. In 1988, greater subclover yields occurred in fertilized inoculated and uninoculated plots. Increased bermudagrass production was found when clover was grown prior to the grass crop. Low numbers of indigenous rhizobia were present at plot establishment and were effective with subterranean clover, but dry matter production was lower in uninoculated plots. All clover plots had from 10^4 to 10^5 rhizobia g soil^{-1} at the end of the first and second clover growing seasons, and these populations remained sufficiently high throughout the experimental period to nodulate emerging clover in subsequent years. 18 refs., 5 tabs.

4616 (RRTAC–89-2, pp. 309-316) **Grain sorghum as a test crop to reclaim prime farmland disturbed for coal mining.** Barnhisel, R.I. (University of Kentucky, Lexington (USA)); Powell, J.L. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume I.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

Data are presented to summarize experiments having the following objectives: (1) determine the yield potential of selected grain sorghum cultivars; (2) determine the effect of soil depth and the previous cropping history on grain sorghum yield; (3) determine the effect of liming the subsoil prior to topsoil replacement on grain sorghum yield. In general, grain sorghum is a good test crop for the evaluation of reclamation success (i.e., productivity) of prime farmland, however, wide variations occur between varieties. Grain sorghum responded to increased soil depth covering the cast overburden, with the greatest yield increase occurring between the 20 and 60 cm depth treatments and a lesser yield response between 60 and 100 cm treatments. The previous cropping history affected grain sorghum yields. Plots that had been in alfalfa and tall fescue during the initial five years of this study outyielded those that were in a corn-wheat-soybean rotation. The application of lime to the acidic subsoil resulted in a significant yield increase. 15 refs., 3 tabs.

4617 (RRTAC–89-2, pp. 339-343) **First-year evaluation for Excelsior pads on loblolly pine.** Davidson, W.H. (USDA Forest Service, Princeton, WV (USA)). Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume I.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

In the spring of 1988 a study was conducted to test the effects of Excelsior pads on loblolly pine survival and growth. Two types of pads were used: American Excelsior Company Tregro type 100 and 200. Bare-root, 1-0 loblolly pine seedlings were mattock planted on April 14 and the pads installed on April 15. The study design was random pairs of treatment (with pad) and control (no pad) seedlings. An evaluation on May 5 showed inconsistent survival that was attributed to planting technique. Three people planted seedlings: two had survival rates of 95 percent while the survival rate for the third

planter was 77 percent. Evaluation at the end of the growing season showed that the pads had no apparent influence on survival. Overall survival was 72 percent with pads and 71 percent without pads. The initial mortality was distributed evenly among treatments, so subsequent measurements were not biased. Nevertheless, seedlings with the type 200 pads were significantly taller than controls or type 100 seedlings. These results show: (1) there is no substitute for good planting technique to ensure seedling survival, and (2) type 200 Tregro pads have a beneficial effect on seedling growth even under the severe drought conditions of 1988. 4 refs., 1 tab.

4618 (RRTAC–89-2, pp. 345-355) **Woodland reclamation within the Missouri Breaks in west central North Dakota.** Nilson, D.J. (Basin Electric Power Cooperative, Stanton, ND (USA)). Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume I.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

Surface mining in the Missouri Breaks requires the removal of deciduous woodlands associated with drainages that flow intermittently toward the Missouri River. Reestablishing these woodlands requires the use of reclamation techniques that maximize plant available water. Grading, soil handling, site selection, plant material and condition, and proper installation and management operations are important to woodland establishment and survival. Survival data and reproductive capabilities of reestablished woodlands provide some insight into whether or not a stand will become a self-perpetuating woodland system. Data collected from tall shrub reclamation study sites established between 1982 and 1984 show initial survival has varied from 54 to 78 percent. However, mean stem densities of shrubs increased 150-375 percent by the end of the third growing season. During the 1988 field season, mean stem densities were within 25 percent of the mean recorded in undisturbed sites. 5 refs., 5 figs., 1 tab.

4619 (RRTAC–89-2, pp. 447-457) **Mining and reclamation of prime farmlands in western North Dakota.** Friedlander, J.D. (Coteau Properties Co., Beulah, ND (USA)). Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume II.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

Prime farmland reclamation is required by the 1977 Surface Mining Control and Reclamation Act. The Coteau Properties Company operates a lignite mine in western North Dakota, and is the only mine in the semiarid west to mine and reclaim large acreages of prime farmland. The characteristics of prime farmlands in western North Dakota are not addressed by Federal regulatory requirements, and conflict with State requirements for reclamation of all croplands in North Dakota. This conflict results in unnecessary additional environmental disturbance during mining, and increased reclamation expense to the mine operator. Reclamation operations at the Freedom Mine are described. Recommended changes to prime farmland regulations and interpretations of existing regulations would enhance overall reclamation for all croplands in western North Dakota, both prime and nonprime. 24 refs., 4 figs.

4620 (RRTAC–89-2, pp. 471-479) **An overview of two decades of regulation on surface coal mining and reclamation in North Dakota.** Dodd, W.E. (North Dakota Public Service Commission, Bismarck (USA). Reclamation Division); Deutsch, J.R.; Englerth, E.J.; Safaya, N.M. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume II.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

In North Dakota, coal (lignite) production and utilization methods have changed considerably since the first commercial coal mine was opened in 1873. Surface mining was started in 1919 and became the exclusive method of coal recovery by 1966. The number of coal mines, mostly small underground operations, declined from an all time high of 320 in 1940 to the current 10 active surface mines. But coal production has increased steadily, reaching 28 million tons in 1988. Today, 78% of North Dakota lignite is used for electrical generation, 20% for synthetic gas production, and the remainder as domestic and commercial fuel. Environmental regulation of North Dakota's lignite industry began in 1969 when the state passed its first mining and reclamation law. Reclamation requirements at that time were limited to topping and seeding the spoil peaks. Since then, the reclamation laws and rules have increased significantly in their scope and stringency and have had a profound effect on the quality and usefulness of lands following mining disturbance. 9 refs.

4621 (RRTAC–89-2, pp. 495-503) **Subsoil thickness effects on crop yield and soil water when reclaiming sodic minespoil.** Oddie, T.A. (Monenco Consultants Ltd., Calgary, Alberta (Canada)); Osborne, A.E.; Graveland, D.N.; Panek, L.A. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume II.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

Minespoil sodicity has the potential to impede reclamation success on surface-mined land. A joint government/coal industry experiment was established near Highvale, Alberta to determine suitable subsoil thicknesses (0, 55, 95, 135, 185 and 345 cm underlying 15 cm topsoil) for reclaiming sodic minespoil and maximizing production of an annual barley (Hordeum vulgare L.) cereal crop or a perennial alfalfa-smooth bromegrass (Medicago sativa L., Bromus inermis Leyss.) forage mixture. Barley and forage yields were lower on the 0 cm subsoil treatment than all other treatments. Yields for both crops increased as subsoil thickness increased to 55 cm. There was a consistent trend toward optimum yields on the 95 cm subsoil treatment, but the difference between 55 and 95 cm was not significant. The replacement of 55 to 95 cm subsoil plus 15 cm topsoil appeared sufficient to restore post-mine productivity to the potential achieved on surrounding agricultural land. Root depth under the forage mixture increased as total soil thickness increased, while increases under the cereal were not generally significant. The average effective root zone extended to about 85 cm under barley and 185 cm under alfalfa-smooth bromegrass. Average seasonal soil water within the effective subsoil root zone generally increased under barley and decreased under alfalfa-smooth bromegrass over time. Accumulations of soil water above the subsoil/minespoil interface under barley were attributed to lower consumptive use of available soil water and a shallower effective root zone compared to forage. Perennial forages appeared to be more effective in reducing soil water accumulations above the interface and promoting reclamation success of sodic minespoil. 28 refs., 5 tabs.

4622 (RRTAC–89-2, pp. 505-515) **The use of bottom ash as a physical amendment to sodic spoil.** Landsburg, S. (NOVA Corporation of Alberta, Calgary (Canada)). Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume II.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

The objectives of this study were to determine the best rate and method of application of bottom ash to sodic spoil in terms of reducing the effects of excess sodium and promoting vegetative growth. Plots were set up as a randomized complete block design and the depths of bottom ash tested were 10, 20 and 30 cm. Ash was incorporated into the spoil surface using a disc, chisel plow and Kellough subsoiler. As a fourth method, ash was left as a blanket on top of the spoil. Results showed the best rate of ash to be 30 cm,

and the best method of incorporation to be subsoiling. Both increased moisture movement downwards and decreased soil strength values which promoted leaching, germination and root growth. The 30 cm rate also improved the chemistry of the surface 15 cm of the spoil and increased yield. All the methods plus the 20 and 30 cm rates produced toxic levels of plant available boron in the soil. The soil concentrations were not reflected in any plant toxicity symptoms. 10 refs., 14 figs., 2 tabs.

4623 (RRTAC–89-2, pp. 523-529) **Corn response to deep tillage on surface-mined prime farmland.** Dunker, R.E. (University of Illinois, Urbana (USA)); Jansen, I.J.; Vance, S.L. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume II.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

The effect on corn growth of using a deep ripper (Kaeble-Gmeinder TLG-12) on reconstructed mine soils was evaluated at Consolidation Coal Company's Norris Mine in west central Illinois during the 1985-86 time period. Two mine soils, one being 45 cm of topsoil replaced over graded wheel spoil and the other being wheel spoil only, were evaluated with and without the TLG-12 treatment. A nearby tract of Sable soil (Typic Haplaquoll) was used as an unmined comparison. The use of the TLG-12 which has an effective depth of approximately 75 cm was successful in significantly lowering penetrometer resistance in the 23-45 cm and 45-69 cm sample segments as compared to the unripped treatments in both mine soils. Corn yield response to the TLG-12 was significant in both 1985 and 1986, although the magnitude of response was greater in 1985, a year of higher climatic stress. Significant differences for pollination dates, % barren stalks, shelling %, and soil moisture tension levels at certain depths were observed between the ripped and unripped treatments. Corn yields averaged over the two year period for both the topsoil and wheel spoil treatment with TLG-12 were comparable to yields produced on the unmined Sable soil, while the two year non-ripped mine soils were not. No yield response to topsoil replacement occurred for either tillage treatment in either 1985 or 1986. Corn yields were significantly correlated with soil strength levels at the 23-69 segment depths. 9 refs., 2 figs., 6 tabs.

4624 (RRTAC–89-2, pp. 531-541) **Battle River Soil Reconstruction Project: five year results of the Torlea soil experiment.** Leskiw, L.A. (Can-Ag Enterprises Ltd., Edmonton, Alberta (Canada)). Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume II.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

The Battle River Soil Reconstruction Project (BRSRP), featuring four experiments, was intensively monitored for five years, 1982-86. Goals were to determine the most effective methods of reclaiming mined lands using different depths and qualities of soil materials. This paper focuses on the Torlea Soil Experiment which was designed to assess the following methods of ameliorating sodicity: (1) removal of the sodic B horizon; (2) mixing the sodic B with calcium enriched C horizon; (3) applying gypsum; and (4) applying calcium rich bottom ash. With respect to crop yields there was no growth without topsoil or subsoil over spoil; poor growth with topsoil over spoil; and good growth with topsoil over subsoil over spoil. Subsoil horizon mixes and variations in depths did not result in statistically significant yield differences; however, deeper subsoils tended to yield better. Amendments proved to be very beneficial: ash outyielded gypsum and control plots. Gypsum treated plots were almost significantly higher yielding than control plots. Yields declined over time likely due to aging forage stands and to differences in rainfall. Soil quality expressed by salinity and sodicity more or less parallels yields in that better yields match better soil quality. Spoil alone is unsuitable for crop growth. Topsoil over spoil is better but salinity and sodicity levels in the topsoil remain moderate and high, respectively. Topsoils and upper subsoils have improved since construction and lower subsoils have degraded indicating leaching in the upper profile and salt accumulation at depth. These changes were more pronounced during the first couple of years than later, indicating that conditions may be stabilizing, at least during current drier than normal weather. Addition of bottom ash to topsoil has been very beneficial in improving soil quality. 35 refs., 6 tabs.

4625 (RRTAC–89-2, pp. 563-573) **Revegetation potential of overburden materials from Kittanning coal mines.** Sencindiver, J.C. (West Virginia University, Morgantown (USA)); Thurman, N.C.; Fugill, R.J. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume II.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

Two independent revegetation studies were conducted on Kittanning overburden materials. Problems with acidity have often been encountered during reclamation of Kittanning coal mines in West Virginia, Maryland, and Pennsylvania. The first study was a field study in which part of a regraded area was covered with local topsoil, but the rest of the area was covered with a topsoil substitute obtained from sandstone in the overburden. This substitute had not been analyzed before use. In this study, the topsoil supported vegetation better than the substitute, since the substitute was acid-producing material. In the second study, minesoil profiles were constructed in 30-cm diameter, 100-cm deep PVC columns. Spoil was covered with topsoil, crushed alkaline sandstone, or a mixture of the topsoil and sandstone. In this study the sandstone, mixture, and spoil with no soil cover supported better vegetative growth than the topsoil. Although Kittanning overburden strata are generally thought to be potentially toxic, the strata should be thoroughly characterized. This study indicates that not all overburden strata above Kittanning coal is toxic and that some has the potential of serving as topsoil substitute. 15 refs., 7 tabs.

4626 (RRTAC–89-2, pp. 579-588) **Coal mine soil and overburden surveys and reclamation planning.** Schori, A. (Monenco Consultants Ltd., Calgary, Alberta (Canada)); Hastie, W.J.; McQueen, D.K.; Minning, G.V.; Wenzel, E.C. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume II.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

The Highvale Mine, located in Central Alberta approximately 65 km west of Edmonton, is one of several large coal strip mines presently operated in agricultural areas of Alberta. Government guidelines require that mined land be returned to a capability equivalent to pre-mine conditions. Detailed soil and overburden surveys were conducted at the Highvale Mine in 1984-85 for areas to be mined in the 25 year period, 1986 through 2011. Soil survey information collected from approximately 1500 field inspections was used to: document the distribution, morphology and chemical/physical properties of soils; determine land capability for agriculture (CLI); determine soil suitability for reclamation; and provide a data base for surface soils. A total of 448 drillholes were completed to determine overburden thickness and to collect samples. Chemical and physical data from drillhole samples were used to describe properties of principal overburden units and to rate overburden materials for reclamation suitability. Information from the soil and overburden programs was integrated to optimize materials handling efficiency and achieve reclamation objectives. 9 refs., 1 fig., 3 tabs.

4627 (RRTAC–89-2, pp. 589-595) **Spatial variability in the chemical and physical properties of regraded mine spoil.** Halvorson, G.A. (North Dakota State University, Mandan (USA). Land Reclamation Research Center). Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary

(Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume II.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

The variability in the chemical and physical properties of regraded mine spoil was measured at four locations in western North Dakota. The ultimate objective of this study is to predict regraded surface properties from core data from the original overburden. The samples were taken from an expanding square pattern so the variability in a small area could be compared to the variability in a large area. The size of the area sampled ranged from 9 sq. m to 55 ha. Spoil properties measured included pH, electrical conductivity, soluble Ca, Mg and Na, sodium adsorption ratio and percent sand, silt and clay. Variability in soil properties as measured by the coefficient of variation in the smallest area was 30-70% of that in the largest area for most parameters at three mines. Difficulties were encountered in matching the premine overburden with the regraded spoil properties because the degree of surface grading following mining was not predictable. Sampling to a depth of 1.2 m in 0.3 m increments did not significantly improve the information available on the variability of spoil properties compared to the surface 0.3 m alone. 12 refs., 3 tabs.

4628 (RRTAC–89-2, pp. 597-606) **Weathering of siderite ($FeCo_3$) from lignite overburden.** Frisbee, N.M. (Texas A & M University, College Station (USA)); Hossner, L.R. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume II.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

Acid/base accounting of minesoils and overburden can have substantial errors using current analytical procedures. There is a correlation between the presence of siderite ($FeCO_3$) and errors in determining the neutralization potential and potential acidity of overburden material. The effects of CO_2, O_2 and air on siderite weathering were measured. Unoxidized siderite blocks were placed in containers with H_2SO_4 or potassium hydrogen phthalate (KHP), both at pH 3.0. Carbon dioxide, O_2 or air was bubbled through the solutions. The solutions were changed regularly and aliquots were analyzed by atomic absorption for Fe. Unoxidized siderite and $CaCO_3$ were used in pH-stat titrations to determine reaction rates at pH 3.0. Iron release from siderite was influenced by gaseous environment and decreased in the order. CO_2>air>O_2. Iron release from siderite was slowed by formation of iron oxide coatings on siderite surfaces in H_2SO_4. Siderite in KHP formed no coatings. Soderite reacts slowly with dilute acid at room temperature but will react rapidly at modestly elevated temperatures. This can result in error in acid/base accounting methods used for overburden and topsoil substitute evaluation when siderite is present. 17 refs., 6 figs., 1 tab.

4629 (RRTAC–89-2, pp. 617-625) **The factors influencing cone penetrometer resistance as a measure of compaction in minespoils.** Thacker, D.J. (Alberta Environmental Centre, Vegreville (Canada). Soils Branch); Johnson, R.L. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume II.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

Cone penetration resistance as a measure of compaction was used to evaluate minespoils from the Luscar geological formation of the Alberta Rocky Mountain Foothills across the plant available moisture range. Three soil textures, two salinity levels and six moisture tensions were tested. There was a well defined relationship between cone penetration resistance, or strength, and moisture tension. Average minespoil strength at 1/3 and 3 bars moisture tension was 40% and 72% of that at 15 bars tension, respectively. Because each minespoil has a different range of cone penetration resistance, depending mainly on texture, an absolute relationship between moisture tension and strength could not be developed. By normalizing the strength values, whereby all values were divided by that obtained at 15 bar moisture tension, a predictive equation relating strength to moisture tension is reported ($r^2$0.92) that is applicable to a wide range of minespoil textures. Clay content and salinity had a significant effect on minespoil strength. Penetration resistance was 2.5 times greater at 33% clay content than at 8% clay. Minespoil strength of saline spoils was 1.25 times that of non-saline spoils. The salinity effect increased as salts precipitated upon drying the minespoil: strength at 15 bars moisture tension in saline minespoils was 1.4 times that of non-saline minespoils. 11 refs., 2 figs., 2 tabs.

4630 (RRTAC–89-2, pp. 635-644) **Effects of phosphatic amendments on yield and elemental composition of corn grown on acid minespoils.** Sencindiver, J.C. (West Virginia University, Morgantown (USA). Division of Plant and Soil Sciences); Bhumbla, D.K. Alberta Land Conservation and Reclamation Council, Edmonton, AB (Canada). Reclamation Research Technical Advisory Committee. 1989. (CONF-890807–: Symposium on reclamation: a global perspective, Calgary (Canada), 27-30 Aug 1989). In *Proceedings of the conference: reclamation, a global perspective. Volume II.* Order Number DE90724308. Available from Publication Services, Queens Printer, 11510 Kingsway Avenue, Edmonton, Alberta, Canada T5G 2Y5.

Greenhouse experiments were conducted to evaluate the growth and chemical composition of three crops of corn grown on limed and unlimed minesoils (from abandoned sites) amended with phosphatic clay, rock phosphate, and monocalcium phosphate. Application rates of phosphatic clay and rock phosphate were 288 and 576 mg P kg^{-1}. Phosphatic clay also was added at 1152 mg P kg^{-1}. Monocalcium phosphate was added at 50 mg P kg^{-1}, and a control had no phosphate amendment. Corn yields were higher on phosphatic clay-treated minesoils than on minesoils treated with rock phosphate or monocalcium phosphate. Yields were generally no better for the highest application rate than they were for the middle rate of phosphatic clay. Phosphatic clay improved the uptake of macronutrients by corn growing on both limed and unlimed minesoils. Concentrations of calcium and phosphorus were significantly higher in tissues of plants grown on phosphatic-clay treated minesoils than on minesoils with other treatments. Tissue concentrations of manganese decreased with increasing levels of phosphatic amendaments. 16 refs., 7 tabs.

0110 Reserves, Geology, and Exploration

Refer also to citation(s) 4576

4631 (BMR–293) **Union list of Australian geological excursion guide books.** Kidd, C.M. Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia). 1989. 73p. Available from Bureau of Mineral Resources, Geology and Geophysics, Canberra, ACT (Australia).

This union list has been compiled to facilitate access to an important category of geoscientific literature - field excursion guides - that commonly does not have a very wide distribution. Details of over 300 excursion guides are recorded in this report, together with a list of the libraries where they can be inspected or borrowed. Locality and map sheet indexes have been provided to assist users.

0120 Mining

Refer also to citation(s) 4597, 4599, 4603, 4604, 4605, 4606, 4607, 4608, 4609, 4610, 4611, 4612, 4613, 4614, 4615, 4616, 4617, 4618, 4619, 4620, 4621, 4622, 4623, 4624, 4625, 4626, 4627, 4628, 4629, 4630, 4649, 4650, 4666, 4667, 4670, 4671, 4672, 4673

4632 (CMRC–82/52-BG) **Draft guidelines of procedure for surveying underground mines in Alberta.** Wright, P.L. Coal Mining Research Centre, Edmonton, AB (Canada). Aug 1982. 116p. (CE–02415). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: $0.34 CAN per page, $3.40 minimum.

Guidelines are presented for underground mine surveys in Alberta coal mines. They are based on the code developed by the National Coal Board in Great Britain. The guidelines have been

amended to satisfy the statutory requirements for plans of underground coal mine workings specified in Alberta provincial legislation. Sections of these guidelines define statutory working plans, general surveying procedure, limits of error, operational safety precautions, information required for rescue boreholes, and geological record keeping. Appendices are included on general surveying procedures, reprinted from other sources. 27 figs.

4633 (DOE/EIA–0118(88)) **Coal production 1988.** USDOE Energy Information Administration, Washington, DC (USA). Office of Coal, Nuclear, Electric and Alternate Fuels. 22 Nov 1989. 144p. Sponsored by U.S. DOE Management & Administration. Order Number DE90003432. Available from NTIS, PC A07/MF A01 - GPO - OSTI; GPO Dep.

Coal Production 1988 provides comprehensive information about US coal production, the number of mines, prices, productivity, employment, reserves, and stocks to a wide audience including Congress, Federal and State agencies, the coal industry, and the general public. This report also includes data for the demonstrated reserve base of coal in the United States on January 1, 1989. 5 figs., 45 tabs.

4634 (IC–9205) **Emission products from combustion of conveyor belts.** Egan, M.R. Bureau of Mines, Pittsburgh, PA (USA). 1988. 12p. Available from US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

A series of experiments were undertaken by the Bureau of Mines to determine the emission products of several types of conveyor belting and other combustible materials found in mines. These experiments were conducted under intermediate scale, stimulated mine conditions to determine smoke characteristics and gas concentrations. From these determinations, heat-release rates, particle sizes, obscuration rates, combustion yields, and production constants were calculated. Three types of belts were investigated: chloroprene, also known as neoprene (NP); polyvinyl chloride (PVC); and styrene-butadiene rubber (SBR). The belts were designated as ignitable or self-extinguishing depending on the length of the burning time and the subsequent combustion products. These conveyor belt combustion results are compared with previous analyses of wood, transformer fluid, and coal fires. Together they form a data base by which findings from future experiments with other mine combustibles can be compared.

4635 (MSHA/IR–1156) **Respirable coal mine dust sample processing.** Raymond, L.D.; Tomb, T.F.; Parobeck, P.S. Mine Safety and Health Administration, Denver, CO (USA). 1987. 25p. Sponsored by U.S. Department of Labor. Order Number DE90003744. Available from NTIS, PC A03/MF A01 - OSTI.

The Federal Coal Mine Health and Safety Act of 1969 established mandatory dust standards for coal mines. Regulatory requirements for complying with the provisions of the Act were prescribed in Title 30, Code of Federal Regulations, Parts 70 and 71, which were published in the Federal Register on April 3, 1970, and March 28, 1972, respectively. These standard and sampling requirements of coal mine operators, along with a description of the laboratory which was established to process respirable coal mine dust samples collected in accordance with these requirements, were published in MESA Informational Report (MESA, the acronym for the Mining Enforcement and Safety Administration, was changed to MSHA, the acronym for the Mine Safety and Health Administration, in 1977). These standards and regulatory requirements continued under the Federal Mine Safety and Health Act of 1977 until November 1980, when major regulatory revisions were made in the operator's dust sampling program. This paper describes the changes in the respirable coal mine dust sampling program and the equipment and procedures used by MSHA to process respirable coal mine dust samples collected in accordance with regulatory requirements. 10 figs., 1 tab.

4636 (MSHA/IR–1162) **A coal mine ventilation survey method.** Hadden, J.D. Jr.; Smith, R.L. Mine Safety and Health Administration, Denver, CO (USA). 1987. 72p. Sponsored by U.S. Department of Labor. Order Number DE90003745. Available from NTIS, PC A04/MF A01 - OSTI.

This report presents a practical, working tool for conducting mine ventilation surveys under conditions found in most coal mines. It describes a method used by the Pittsburgh Health Technology Center, Mine Safety and Health Administration for conducting these surveys. The procedures outlined include conducting air pressure and air quality surveys underground, and fan pressure readings on the surface. A brief description of how the data gathered is prepared for a digital computer program simulator evaluation is included in the report. 16 refs., 18 figs.

4637 (MSHA/IR–1194) **A comparison of dust data from 29 select underground coal mines 1968–1986.** Raymond, L.D.; Tomb, T.F. Mine Safety and Health Administration, Denver, CO (USA). Safety and Health Technology Center. 1989. 23p. Sponsored by U.S. Department of Labor. Order Number DE90003746. Available from NTIS, PC A03/MF A01 - OSTI.

The Federal Coal Mine Health and Safety Act of 1969 established mandatory dust standards for coal mines. These standards and regulatory requirements were continued under the Federal Mine Safety and Health Act of 1977 until November, 1980, when major regulatory revisions were made in the operators' sampling program. This paper presents a compilation and analysis of mine operator dust data for selected mines which were surveyed prior to enactment of the 1969 Act and are still in a production status. Data obtained since the November, 1980, revisions to the Act through December 31, 1986, are compared to data compiled and presented in previous studies. 8 figs., 1 tab.

4638 (RI–9209) **Closed loop control for a continuous mining machine.** Sammayco, J.J. Bureau of Mines, Pittsburgh, PA (USA). 1988. 17p. Available from US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

As part of a project to automate coal extraction, computer control of a continuous mining machine test bed has been developed and tested by the Bureau of Mines. A computer system and control software were developed for accurate positioning of the conveyor elevation and swing, stabilizer jack, gathering head, and shear elevation. Tramming actions are also controlled by the computer. The computer system was designed to access data from sensors installed on a continuous miner and to interface with the existing control circuits of the miner. Testing in free space was used to characterize the operation of the machine. From this information, control algorithms were written and stored in the computer. The ability to control each function of the continuous miner with a high degree of accuracy and stability was successfully demonstrated in a series of tests in free space and in mining a block of simulated coal.

0130 Transport, Handling, and Storage

Refer also to citation(s) 4589

4639 (DOE/PC/88949–T4) **Advanced study in solid transport: Rheological behavior of dense suspension: Fourth quarterly report, July 1, 1989–September 30, 1989.** Kim, H.J. (Pittsburgh Univ., PA (USA). Dept. of Mechanical Engineering); Chen, J.L.; Roidt, R.M.; Burgman, H.A. Westinghouse Electric Corp., Pittsburgh, PA (USA). Science and Technology Center. 10 Oct 1989. 40p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88949. Order Number DE90003369. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The dynamic shear stress of glass beads has been measured for various combinations of water content, shearing zone height, speed, and normal stress. Equipment and a procedure have been developed to mix uniformly the glass beads with water. A procedure for performing dynamic shear stress experiments has been established. The effects of parameters are discussed. From the results of the present experiments, it is concluded that a smaller shearing zone height and a precise measure of water content are required. In the next experiment, the effects of glass bead particle size and size distribution will be examined. The velocity distribution will also be measured. In addition, we will measure packing fraction as a function of load in order to correct for water void fraction. 12 figs., 1 tab.

0140 Combustion

Refer also to citation(s) 4589, 4670, 4738, 4988, 5372

4640 (DECG–432G494) **Characterization of circulating AFBC [atmospheric fluidized bed combustion] wastes.** Kissel,

R. Dearborn Environmental Consulting Group, Mississauga, ON (Canada). Dec 1986. vp. (CE–02793). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

Circulating atmospheric fluidized bed combustion (CAFBC) is a new technology which has the capability of combusting problem solid fuels such as high sulphur coal while achieving strict air emission requirements. There is very limited data on the characteristics of residues from this process. The overall objective of this study was to determine the properties of CAFBC wastes in order to identify the potential impacts of their disposal. A variety of coals were combusted with several limestones in a 12.7 cm diameter, 5.8 m high pilot plant in order to generate representative samples for subsequent characterization and assessment. This was necessary since no suitable demonstration of full scale CAFBC units was in operation at the time of this study. These residues were subjected to detailed physical, chemical, exothermicity, leaching, and geotechnical testing so that the environmental effects, waste management, disposal considerations and utilization potential of the combustion residues could be determined. The properties of the CAFBC residues were compared with those from the bubbling process, for which a wider background on waste properties is available. Recommendations arising from this study for further research to more fully define the handling and disposal requirements and utilization potential for these wastes were made. 176 refs., 23 figs., 38 tabs.

4641 (DOE/PC/79652–T2) **L-Star pulsed coal combustor for residential space heating: Final report.** Avco-Everett Research Lab., Everett, MA (USA). May 1989. 97p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-87PC79652. Order Number DE90000644. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

A residential scale coal combustor has been developed based on the L-Star pulsed combustion principle. The optimized configuration leads to a compact system which combusts greater than 99 percent coal carbon with dry micronized de-ashed lignite. The system meets or surpasses the performance goals set for the project. The combustor has a short response time (2–3 minutes to full load) and has been tested in both continuous and residential (ON/OFF) modes. The system has been operated for over 300 hours with over 100 hours with the final configuration. There is virtually no noise due to combustion and it produces low NO_x (250–300 ppm). No support fuel is required, except for initial start-up from dead-cold conditions. The experimental system could be developed into a viable package for residential space heating, using de-ashed lignite fuel described in this report. More effort would be required to adapt the design to larger thermal throughputs and other coal fuels. 11 refs., 51 figs., 12 tabs.

4642 (DOE/PC/79916–7) **Determination of local radiative properties in coal-fired flames: Technical progress report, September 15, 1988–September 15, 1989.** Menguec, M.P. Kentucky Univ., Lexington, KY (USA). Dept. of Mechanical Engineering. 1989. 45p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-87PC79916. Order Number DE90003315. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During the second year of this project, we have made progress in several areas, including the theoretical inverse analyses and the experiments with the cold-coal-flow system and the pulverized-coal-burner. The discussion in this report is divided into two main components to cover (A) Basic and Theoretical Studies, and (B) Experimental Studies. In part (A), we will discuss our recent efforts for the inverse solution of radiative transfer equation. Inverse analysis, which is based on a direct solution of the radiative transfer equation, is essential to recover radiative properties from the experimental data. The direct problem here can be considered as the propagation of radiation in a participating medium. In addition to the inverse method developed for cylindrical geometries, we also need to develop an inverse solution technique for plane-parallel, anisotropically scattering medium, which is to be used for cold-coal flow experiments. For this purpose, we have chosen to use a versatile Monte Carlo technique, and have shown that it is a very promising approach. In part (B), we discuss the experimental apparati developed to measure the radiative intensity distribution using a CO_2 laser nephelometer. Recently, we accomplished to have a uniform, steady flow of pulverized-coal particles in a slab-geometry. Also, we developed a very accurate calibration scheme using glass particles with known size and complex index of refraction. 2 refs., 23 figs., 8 tabs.

4643 (DOE/PC/90279–T15) **Advanced coal-fueled combustor for residential space heating applications: Prototype design report.** Kwan, Y.; Chen, S.L.; Seeker, W.R. Energy and Environmental Research Corp., Irvine, CA (USA). Jun 1989. 27p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-86PC90279. Order Number DE90003312. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report reviews the design of the prototype coal-fired space heating system for residential applications. The entire unit comprises the following key components, namely: a combustor, heat exchanger, and ash collector. The design of this optimized combustor consists of a short refractory quarl, swirl stabilized burner and a double shell combustion chamber made of stainless steel. The burner was designed to burn dry ultrafine, high volatile bituminous coal at a nominal firing rate of 100 x 10^3 Btu/hr and 30 percent excess air. The combustor was designed to utilize the combustion air as cooling air for the chamber. The combustion chamber was designed to yield a gas phase residence time of approximately 1 second. The heat exchanger is a commercial design, by the Will-Burt Company. The unit is engineered for minimum pressure drop and maximum heated surfaces for heat transfer. Particulate laden flue gas clean-up is achieved by an ash collector which consists of primarily a bag filter and is designed for easy ash removal and cleaning. 2 refs., 12 figs., 2 tabs.

4644 (EUR–12066-FR, pp. 203-236) **The behaviour of salt minerals in coals during fluidised bed combustion.** Hodges, N.J. (British Coal Corporation, Stoke Orchard (United Kingdom). Coal Research Establishment); Marsh, M.K.; McCaffrey, D.J.A. Commission of the European Communities, Brussels (Belgium). 1989. (CONF-8812120–: Round table meeting on chemical and physical valorization of coal, Brussels (Belgium), 21 Dec 1988). In *Round table meeting 'chemical and physical valorization of coal'*. Order Number DE90724050.

Combustion of three UK bituminous coals in a laboratory (70 mm) fluidized bed combustor has shown that condensing salts of sodium, potassium and calcium chlorides and sulphates, and possibly low melting point eutectics, act as adhesives, fixing impinging gas borne particulates and causing deposit build-up. Such initial salt rich deposits were significantly reduced for the coal with the lowest ionisable salt mineral content. The effect of varying combustion parameters, of probe and bed temperatures, coal feed rate, fluidising gas velocity, combustion atmosphere and time, on the nature and extent of deposition has been evaluated. The results suggest that maximum deposition occurred on probe surfaces of between 500 degrees C and 600 degrees C. Increasing the bed temperature from 850 to 925 degrees C increased the abundance of sodium, calcium, magnesium and sulphate deposited. Lower oxygen atmospheres favoured deposition of chlorides as opposed to sulphates whereas lower fluidising gas velocities seemingly favoured the deposition of sulphates over chlorides. Deposition rates of the monitored salts appeared to be at least partially dependent on the deposit surface temperature and on the formation of the initial semi molten layer. Coal feed rate had little effect on the nature and extent of deposition. 4 refs., 20 figs., 4 tabs.

4645 (UCRL–21232) **Tubing wastage in fluidized-bed coal combustors (Grimethorpe PFBC [pressurized fluidized-bed combustion] Tube Bank "E").** Witherell, C.E. Lawrence Livermore National Lab., CA (USA). 4 Oct 1989. 56p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-7405-ENG-48. Order Number DE90003598. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Samples of evaporator tubing from Tube Bank "E" of the Grimethorpe pressurized fluidized-bed combustion (PFBC) facility in the UK were examined in the third of a series of studies being conducted at Lawrence Livermore National Laboratory (LLNL) under sponsorship of the US Department of Energy's Morgantown Energy Technology Center (METC). The program is being conducted to identify the mechanism or mechanisms responsible for metal loss

(wastage) of in-bed carbon-steel evaporator tubes in bubbling-bed coal combustors. Results of examination suggest that bed conditions were less aggressive than in previous experiments in this combustor; however, tubing wastage was observed in some samples. Observations made on these tubes are consistent with the hypothesis of tubing wastage proposed in reports of previous LLNL studies conducted under this program that the dominant cause of metal loss is exfoliation of the normally-protective oxide scale by impacting bed particulates. Good correlation was also observed with trends noted earlier that microstructure of the tubing steel plays a role in its wastage response. 12 refs., 29 figs., 3 tabs.

0150 Economic, Industrial, and Business Aspects

Refer also to citation(s) 5269, 5274

4646 (CONF-8903176–1) **The importance of purchase prices in electric utility fuel choice: An analysis of recent evidence.** Hemphill, R.C.; Costello, K.W.; McDonald, J.F.; South, D.W. Argonne National Lab., IL (USA). [1989]. 36p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. From 53. annual meeting of the Midwest Economics Association; Cincinnati, OH (USA); 30 Mar - 1 apr 1989. Order Number DE90002244. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper assesses the future role of oil/natural gas in the electric utility industry, in particular over the next several years. In doing this, it reviews and interprets the impressions and reactions of experts to the changing fossil fuels market. Further, it presents an independent statistical analysis of fuel-choice decisions since the early 1980s. The Electric Fuel Use Database (EFUD) is developed from EIA sources to create sixty months of data covering the period 1982–1986 and 180 electric utilities. The statistical analysis focuses on the decisions of electric utilities to consume different fossil fuels during a period in which oil/natural gas became increasingly attractive. A regression model is developed to measure the separate effects of fuel prices and other factors affecting fuel choice. The model, in particular, is intended to measure the extent of interfuel substitution by electric utilities in recent years. 15 refs., 2 figs., 14 tabs.

4647 (DOE/EIA–0121(89/2Q)) **Quarterly coal report, April–June, 1989.** USDOE Energy Information Administration, Washington, DC (USA). Office of Coal, Nuclear, Electric and Alternate Fuels. Nov 1989. 144p. Sponsored by U.S. DOE Management & Administration. Order Number DE90003402. Available from NTIS, PC A07/MF A01 - OSTI; GPO Dep.

The Quarterly Coal Report provides comprehensive information about US coal production, exports, imports, receipts, consumption, and stocks to a wide audience, including Congress, Federal and State agencies, the coal industry, and the general public. This issue presents detailed quarterly data for April through June 1989, aggregated quarterly historical and projected data for 1981 through 1990, and aggregated annual historical and projected data for 1960 through 2000. 7 figs., 37 tabs.

0160 Health and Safety

Refer also to citation(s) 4634, 4635

4648 (IC–9192) **Characterization of the 1986 coal mining workforce.** Butani, S.J.; Bartholemew, A.M. Bureau of Mines, Pittsburgh, PA (USA). 1988. 76p. Available from US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

In 1986, the Bureau of Mines conducted a probability sample survey, Mining Industry Population Survey, to measure such employee characteristics as occupation; principal equipment operated; work location at the mine; present job, present company, and total mining experience; job-related training during the last 2 yr; age; sex; race; and education. The population estimates are necessary to properly analyze the Mine Safety and Health Administration (MSHA) injury (includes illness and fatality data) statistics; that is, to compare and contrast injury rates for various subpopulations in order to identify those groups that are exhibiting higher than average injury rates. This report uses the survey's results to characterize the U.S. coal mining workforce from March through September 1986.

4649 (IC–9207) **A seal breaching operation in Quinland coal mine: A case study.** Doyle-Coombs, D.M.; Hansford, R. Bureau of Mines, Pittsburgh, PA (USA). 1988. 21p. Available from US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

In late July 1985, air samples from a sealed portion of the Quinland coal mine in West Virginia showed the presence of carbon monoxide (CO). Mine Safety and Health Administration (MSHA) personnel concluded that a fire was burning behind the seals. Since an imminent danger existed, the mine operator was given a closure order. The gases behind the seals were monitored, and almost 2 million ft^3 of carbon dioxide (CO_2) gas was pumped into the sealed area to stabilize the environment. Sixteen days after the closure order was issued, MSHA allowed the mine to return to production. Approximately 1 yr later, mine management submitted a seal breaching request to MSHA in order to drive a set of entries to further develop the mine. The Bureau of Mines established a sampling strategy and monitored gases from behind the sealed area during the breaching operation until the atmosphere was safe. This report is an account of the seal branching conducted by the mine, MSHA, and the Bureau. The logistics of this event, the sampling strategy, and the equations applied could be used by the mining industry in future breachings or mine recovery operations. Time to reenter the area was calculated by using the methane (CH_4) concentrations sampled at the discharge of the seals. Tracer gas was used to verify the ventilation flows through the area.

4650 (IC–9209) **Rollover Protective Structure (ROPS) performance criteria for large mobile mining equipment.** Swan, S.A. Bureau of Mines, Pittsburgh, PA (USA). 1988. 15p. Available from US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

Certain types of mobile surface mining equipment are required to be equipped with rollover protective structures (ROPS) capable of protecting the operator in case of a rollover accident. The Bureau of Mines has developed ROPS performance criteria for wheeled front-end loaders. This report reviews the development of rollover test procedures and subsequent testing of ROPS for 52,000, 286,000, and 390,000 lb gross vehicle weight (GVW) loaders. The program consisted of both dynamic (roll) and static tests to assist in the development of the ROPS performance criteria. Each test included extensive instrumentation and photographic documentation to fully evaluate the performance of the ROPS. Data summarizing side, longitudinal, and vertical force and deflections are included.

4651 (IOM-TM–89-02) **Development of a prototype powered helmet respirator suitable for use in coalmines.** Howie, R.M.; Best, C.F.; Dye, R.W.; Graveling, R.A.; Crawford, N.P.; Dodgson, J. Institute of Occupational Medicine, Edinburgh (UK). May 1989. 46p. Available from Institute of Occupational Medicine, Edinburgh (UK).

A second Institute of Occupational Medicine (IOM) powered helmet respirator (PHR) has been developed as an improvement to a previous prototype. The wearer's perception of airflow has been increased, the weight has been reduced, and balance and stability have been improved by the use of a new cap lamp mounting bracket. Noise levels from the fans have been reduced and vision improved. Wearer trials indicated that the helmet is more acceptable than previous versions. 11 refs., 6 figs., 11 tabs.

4652 (IOM-TM–89-05) **Causes of disability in coalminers: a clinico-pathological study of emphysema, airways obstruction and massive fibrosis.** Ruckley, V.A.; Fernie, J.M.; Campbell, S.J.; Cowie, H.A. Institute of Occupational Medicine, Edinburgh (UK). May 1989. 159p. Available from Institute of Occupational Medicine, Edinburgh (UK).

The report is based on autopsy studies of coalworker's lungs. The autopsy group included higher proportions of men dying from bronchitis, emphysema and pneumoconiosis than did the parent mortality population. It is concluded that control of dust exposure continues to be an important goal for the containment of both the development of massive fibrosis and the occurrence of emphysema. It is clear also that smoking is a major contributor to respiratory ill-health. 81 refs., 30 figs., 59 tabs.

4653 (MSHA/IR–1157) **Injury experience in coal mining, 1986.** Mine Safety and Health Administration, Denver, CO (USA).

1987. 395p. Sponsored by U.S. Department of Labor. Order Number DE90003731. Available from NTIS, PC A17/MF A01 - OSTI.

This Mine Safety and Health Administration (MSHA) informational report reviews in detail the occupational injury and illness experience of coal mining in the United States for 1986. Data reported by operators of mining establishments concerning work injuries are summarized by work location, accident classification, part of body injured, nature of injury, occupation, and anthracite or bituminous coal. Related information on employment, worktime, and operating activity also is presented. Data reported by independent contractors performing certain work at mining locations are depicted separately in this report. For ease of comparison between coal mining and the metal and nonmetal mineral mining industries, summary reference tabulations are included at the end of both the operator and the contractor sections of this report. 1 fig., 46 tabs.

4654 (MSHA/IR–1158) **Injury experience in metallic mineral mining, 1986.** Mine Safety and Health Administration, Denver, CO (USA). Safety and Health Technology Center. 1987. 280p. Sponsored by U.S. Department of Labor. Order Number DE90003735. Available from NTIS, PC A13/MF A01 - OSTI.

This Mine Safety and Health Administration (MSHA) informational report reviews in detail the occupational injury and illness experience of metallic mineral mining in the United States for 1986. Data reported by operators of mining establishments concerning work injuries are summarized by work location, accident classification, part of body injured, natured of injury, occupation, and principal type of mineral. Related information on employment, worktime, and operating activity also is presented. Data reported by independent contractors performing certain work at mining locations are depicted separately in this report. For ease of comparison with other metal and nonmetallic mineral mining industries and with coal mining, summary reference tabulations are included at the end of both the operator and the contractor sections of this report. 3 figs., 46 tabs.

4655 (MSHA/IR–1159) **Injury experience in nonmetallic mineral mining (Except stone and coal), 1986.** Mine Safety and Health Administration, Denver, CO (USA). Safety and Health Technology Center. 1987. 295p. Sponsored by U.S. Department of Labor. Order Number DE90003736. Available from NTIS, PC A13/MF A01 - OSTI.

This Mine Safety and Health Administration (MSHA) informational report reviews in detail the occupational injury and illness experience of nonmetallic mineral mining (except stone and coal) in the United States for 1986. Data reported by operators of mining establishments concerning work injuries are summarized by work location, accident classification, part of body injured, nature of injury, occupation, and principal type of mineral. Related information on employment, worktime, and operating activity also is presented. Data reported by independent contractors performing certain work at mining locations are depicted separately in this report. For ease of comparison with other metal and nonmetallic mineral mining industries and with coal mining, summary reference tabulations are included at the end of both the operator and the contractor sections of this report. 3 figs., 46 tabs.

4656 (MSHA/IR–1160) **Injury experience in stone mining, 1986.** Mine Safety and Health Administration, Denver, CO (USA). 1987. 450p. Sponsored by U.S. Department of Labor. Order Number DE90003739. Available from NTIS, PC A20/MF A01 - OSTI.

This Mine Safety and Health Administration (MSHA) informational report reviews in detail the occupational injury and illness experience of stone mining in the United States for 1986. Data reported by operators of mining establishments concerning work injuries are summarized by work location, accident classification, part of body injured, nature of injury, occupation, and principal type of mineral. Related information on employment, worktime, and operating activity also is presented. Data reported by independent contractors performing certain work at mining locations are depicted separately in this report. For ease of comparison with other metal and nonmetallic mineral mining industries and with coal mining, summary reference tabulations are included at the end of both the operator and the contractor sections of this report. 3 figs., 46 tabs.

4657 (MSHA/IR–1161) **Injury experience in sand and gravel mining, 1986.** Mine Safety and Health Administration, Denver, CO (USA). 1987. 112p. Sponsored by U.S. Department of Labor. Order Number DE90003740. Available from NTIS, PC A06/MF A01 - OSTI.

This Mine Safety and Health Administration (MSHA) informational report reviews in detail the occupational injury and illness experience of sand and gravel mining in the United States for 1986. Data reported by operators of mining establishments concerning work injuries are summarized by work location, accident classification, part of body injured, nature of injury, and occupation. Related information on employment, worktime, and operating activity also is presented. Data reported by independent contractors performing certain work at mining locations are depicted separately in this report. For ease of comparison with other metal and nonmetallic mineral mining industries and with coal mining, summary reference tabulations are included at the end of both the operator and the contractor sections of this report. 3 figs., 38 tabs.

4658 (MSHA/IR–1164) **Injury experience in coal mining, 1987.** Mine Safety and Health Administration, Denver, CO (USA). Safety and Health Technology Center. 1988. 391p. Sponsored by U.S. Department of Labor. Order Number DE90003742. Available from NTIS, PC A17/MF A01 - OSTI.

This Mine Safety and Health Administration (MSHA) informational report reviews in detail the occupational injury and illness experience of coal mining in the United States for 1987. Data reported by operators of mining establishments concerning work injuries are summarized by work location, accident classification, part of body injured, nature of injury, occupation, and anthracite or bituminous coal. Related information on employment, worktime, and operating activity also is presented. Data reported by independent contractors performing certain work at mining locations are depicted separately in this report. For ease of comparison between coal mining and the metal and nonmetal mineral mining industries, summary reference tabulations are included at the end of both the operator and the contractor sections of this report. 3 figs., 46 tabs.

4659 (MSHA/IR–1165) **Injury experience in metallic mineral mining, 1987.** Mine Safety and Health Administration, Denver, CO (USA). 1988. 297p. Sponsored by U.S. Department of Labor. Order Number DE90003730. Available from NTIS, PC A13/MF A01 - OSTI.

This Mine Safety and Health Administration (MSHA) informational report reviews in detail the occupational injury and illness experience of metallic mineral mining in the United States for 1987. Data reported by operators of mining establishments concerning work injuries are summarized by work location, accident classification, part of body injured, nature of injury, occupation, and principal type of mineral. Related information on employment, worktime, and operating activity also is presented. Data reported by independent contractors performing certain work at mining locations are depicted separately in this report. For ease of comparison with other metal and nonmetallic mineral mining industries and with coal mining, summary reference tabulations are included at the end of both the operator and the contractor sections of this report. 3 figs., 44 tabs.

4660 (MSHA/IR–1166) **Injury experience in nonmetallic mineral mining (except stone and coal), 1987.** Mine Safety and Health Administration, Denver, CO (USA). Safety and Health Technology Center. 1988. 306p. Sponsored by U.S. Department of Labor. Order Number DE90003737. Available from NTIS, PC A14/MF A01 - OSTI.

This Mine Safety and Administration (MSHA) informational report reviews in detail the occupational injury and illness experience of nonmetallic mineral mining (except stone and coal) in the United States for 1987. Data reported by operators of mining establishments concerning work injuries are summarized by work location, accident classification, part of body injured, nature of injury, occupation, and principal type of mineral. Related information on employment, worktime, and operating activity also is presented. Data reported by independent contractors performing certain work at mining locations are depicted separately in this report. For ease of comparison with other metal and nonmetallic mineral mining industries and with coal mining, summary reference tabulations are included at the end of both the operator and the contractor sections of this report. 13 figs., 46 tabs.

4661 (MSHA/IR–1167) **Injury experience in stone mining, 1987.** Mine Safety and Health Administration, Denver, CO (USA).

Safety and Health Technology Center. 1988. 478p. Sponsored by U.S. Department of Labor. Order Number DE90003734. Available from NTIS, PC A21/MF A01 - OSTI.

This Mine Safety and Health Administration (MSHA) informational report reviews in detail the occupational injury and illness experience of stone mining in the United States for 1987. Data reported by operators of mining establishments concerning work injuries are summarized by work location, accident classification, part of body injured, nature of injury, occupation, and principal type of mineral. Related information on employment, worktime, and operating activity also is presented. Data reported by independent contractors performing certain work at mining locations are depicted separately in this report. For ease of comparison with other metal and nonmetallic mineral industries and with coal mining, summary reference tabulations are included at the end of both the operator and the contractor sections of this report. 3 figs., 46 tabs.

4662 (MSHA/IR–1190) **Injury experience in metallic mineral mining, 1988.** Mine Safety and Health Administration, Denver, CO (USA). 1989. 297p. Sponsored by U.S. Department of Labor. Order Number DE90003738. Available from NTIS, PC A14/MF A01 - OSTI.

This Mine Safety and Health Administration (MSHA) informational report reviews in detail the occupational injury and illness experience of metallic mineral mining in the United States of 1988. Data reported by operators of mining establishments concerning work injuries are summarized by work location, accident classification, part of body injured, nature of injury, occupation, and principal type of mineral. Related information on employment, worktime, and operating activity also is presented. Data reported by independent contractors performing certain work at mining locations are depicted separately in this report. For ease of comparison with other metal and nonmetallic mineral mining industries and with coal mining, summary reference tabulations are included at the end of both the operator and the contractor sections of this report. 3 figs., 46 refs.

4663 (MSHA/IR–1191) **Injury experience in nonmetallic mineral mining (except stone and coal), 1988.** Mine Safety and Health Administration, Denver, CO (USA). Safety and Health Technology Center. 1989. 321p. Sponsored by U.S. Department of Labor. Order Number DE90003732. Available from NTIS, PC A15/MF A01 - OSTI.

This Mine Safety and Health Administration (MSHA) informational report reviews in detail the occupational injury and illness experience of nonmetallic mineral mining (except stone and coal) in the United States for 1988. Data reported by operators of mining establishments concerning work injuries are summarized by work location, accident classification, part of body injured, nature of injury, occupation, and principal type of mineral. Related information on employment, worktime, and operating activity also is presented. Data reported by independent contractors performing certain work at mining locations are depicted separately in this report. For ease of comparison with other metal and nonmetallic mineral mining industries and with coal mining, summary reference tabulations are included at the end of both the operator and the contractor sections of this report. 3 figs., 46 tabs.

4664 (MSHA/IR–9003752) **Annual report of the secretary of labor under the Federal Mine Safety and Health Act of 1977: Fiscal year 1982.** Mine Safety and Health Administration, Denver, CO (USA). [1982]. 146p. Sponsored by U.S. Department of Labor. Order Number DE90003752. Available from NTIS, PC A07/MF A01 - OSTI.

In fiscal 1982, the mine safety record improved in several categories over the previous year, but declined in others. There were 220 mining deaths in fiscal year 1982 compared to 222 fatalities in 1981. In coal mining, there were 160 fatalities in fiscal 1982 compared with 131 the previous year. In metal and nonmetal mining in fiscal 1982, there were 60 fatalities, compared to 91 deaths recorded in fiscal 1981. In coal mining, the fatality rate, which factors in employment variations, was .07 per 200,000 employee-hours worked in fiscal 1982 compared to a .06 rate during the previous year. In metal and nonmetal mining, the fatality rate per 200,000 employee-hours was .04 in fiscal 1982 compared with .03 the previous year. In both industries, the rates of all injuries declined. On Dec. 7, 1981, an underground coal mine dust explosion took the lives of eight miners at the Adkins Coal Co,'s No. 11 mine at Kite, Knott County, KY. A day later, Dec. 8, 1981, an underground coal mine explosion killed 13 miners at Grundy Mining Co.'s No. 21 mine at Whitwell, Marion County, Tenn. During the following month, on Jan. 20, 1982, another coal mine dust explosion killed seven underground coal miners at the RFH mine in Craynor, Floyd County, KY. 7 figs., 33 tabs.

4665 (MSHA/IR–90003751) **Annual report of the secretary of labor under the federal mine safety and health act of 1977: Fiscal year 1987.** Mine Safety and Health Administration, Denver, CO (USA). Safety and Health Technology Center. [1989]. 150p. Sponsored by U.S. Department of Labor. Order Number DE90003751. Available from NTIS, PC A07/MF A01 - OSTI.

This annual report for FY 1987 covers the period from Oct. 1, 1986, through Sept. 30, 1987. The report is intended to present a broad picture of the agency's activities. Charts and statistical tables providing further details are included in an appendix. Data on worktime, employment, and injuries presented in this report are compiled from information supplied by mine operators on a mandatory basis. Unless otherwise noted, data on mine office workers are included in the figures reported. It should be noted that the data cover only mining operations subject to the 1977 Act and do not include oil and gas extraction activities. Reportable injuries are comprised of fatalities, "nonfatal injuries with days lost" (NFDL injuries), and "no-days-lost" injuries (NDL injuries). The category of NFDL injuries includes cases in which the accident victim missed a day or more of work, and cases in which the victim continued to work but was put on light duty for a day or more. NDL injuries include cases in which the miner lose no time from the job, but needed medical treatment. 14 figs., 44 tabs.

4666 (PB–89-234066/XAB) **Coal-underground fatalities. Second half-1988. Abstracts with illustrations. Analysis and suggested uses.** Mine Safety and Health Administration, Arlington, VA (USA). 1989. 25p. Available from NTIS, PC A03/MF A01.

Also available from Supt. of Docs. See also PB–89-234074.

The 1988 Fatal Illustration Program is divided into four large subject areas. These categories are underground coal mining, surface coal mining, underground metal/nonmetal mining, and surface metal/nonmetal mining. The materials in this unit include illustrated abstracts of all chargeable underground-coal-mining fatalities for the second six months of 1988 accompanied by 35-mm slides and a statistical analysis of the accidents in that category. The package of materials, through its abstracts, slides, and statistics, has been an effective training tool for the mining industry, especially small mines. The program has been used by various companies in safety meetings, annual refresher training, new miner training, and task training.

4667 (PB–89-234074/XAB) **Coal-surface fatalities. Second half-1988. Abstracts with illustrations. Analysis and suggested uses.** Mine Safety and Health Administration, Arlington, VA (USA). 1989. 25p. Available from NTIS, PC A03/MF A01.

Also available from Supt. of Docs. See also PB–89-234066.

The 1988 Fatal Illustration Program is divided into four large subject areas. These categories are underground coal mining, surface coal mining, underground metal/nonmetal mining, and surface metal/nonmetal mining. The materials in this unit include illustrated abstracts of all chargeable surface-coal-mining fatalities for the second six months of 1988 accompanied by 35-mm slides and a statistical analysis of the accidents in that category. The package of materials, through its abstracts, slides, and statistics, has been an effective training tool for the mining industry, especially small mines. The program has been used by various companies in safety meetings, annual refresher training, new miner training, and task training.

4668 (PB–89-238240/XAB) **NIOSH (National Institute for Occupational Safety and Health) testimony to Subcommittee on Manpower, Compensation, and Health and Safety, House Committee on Education and Labor by Dr. John F. Finklea, October 7, 1975.** National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). 7 Oct 1975. 9p. Available from NTIS, PC A02/MF A01.

Testimony before the Subcommittee on Manpower, Compensation, and Health and Safety concerned the research and technical-assistance activities of NIOSH in the area of mine safety and health. Under the Federal Coal Mine Health and Safety Act of

1969 NIOSH, at the Morgantown, West Virginia location, studied the protection of life and health, the detection of respiratory impairment, and the prevention of occupational diseases of coal miners. The institute established additional coal mine health standards and assured the availability of medical examinations for underground coal miners. The Testing and Certification Laboratory evaluated and approved respirators, coal-mine-dust personal-sampler units, and gas detector tubes. NIOSH has developed recommended standards for some of the most important health hazards facing workers in metal and nonmetallic mines including noise, asbestos, silica, beryllium, inorganic arsenic, inorganic mercury, carbon monoxide, and nitrogen oxides. Cooperative work with other agencies was described. Studies involving uranium, asbestos, potash, and copper industries are noted. Observations concerning a rational approach to the scientific and regulatory problems of Federal occupational and environmental health programs were included.

4669 (PB–89-238265/XAB) **NIOSH (National Institute for Occupational Safety and Health) testimony to Subcommittee on Energy Research, Development and Demonstration, House Committee on Science and Technology by Dr. John F. Finklea, February 11, 1976.** National Inst. for Occupational Safety and Health, Cincinnati, OH (USA). 11 Feb 1976. 13p. Available from NTIS, PC A03/MF A01.

This testimony before the Subcommittee on Energy Research, Development and Demonstration concerned the efforts of NIOSH in the area of fossil energy. NIOSH was given the mandate to establish health standards for underground coal mines and the authority to develop these standards. A standard for quartz exposure was established on March 16, 1971. Maximum allowed noise exposures were set on July 7, 1971. Standards on sanitation, potable water, and disposal of refuse and sewage in underground coal mines were published August 14, 1970. More research on the occupational-health problems of coal miners has been conducted by NIOSH than on any other occupational group. These projects included epidemiologic and clinical studies on early detection, development, and progression of lung disease, and on techniques for relating x-ray findings to pulmonary disease processes. NIOSH has also provided medical examinations and other services for coal miners and funded clinics for the analysis, examination and treatment of respiratory and pulmonary impairments of coal miners. Significant problems encountered by workers in coal gasification, coal liquefaction, and oil shale development were cited. Also addressed were the topics of integrating health research in energy policy decisions, evaluation of the use of animal-cell genetic assays to predict mutagenicity, and the status of interagency cooperation on health hazards of sulfates.

4670 (RI–9206) **Model of coal dust explosion suppression by rock dust entrainment.** Edwards, J.C.; Ford, K.M. Bureau of Mines, Pittsburgh, PA (USA). 1988. 17p. Available from US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

The Bureau of Mines developed a mathematical model to calculate the aerodynamically induced lifting of coal and rock dust from a composite deposition on a mine entry floor and the subsequent transport of the dust ahead of the propagating combustion zone of a coal dust explosion. For a series of experimental explosibility tests approximated by combustion zones that expand at a constant flame velocity, the mass fraction of airborne rock dust ahead of the flame front, as well as the mass fraction overtaken by the combustion zone, was calculated. A statistical analysis of the theoretical results demonstrated with a high level of confidence that the propagating and nonpropagating test samples belonged to separate populations. This analysis was further supported by an independent model of the average temperature over the combustion zone.

4671 (RI–9207) **Fire endurance of mine stoppings.** Ng, D.; Lazzara, C.P.; Muva, K.E.; Luster, C. Bureau of Mines, Pittsburgh, PA (USA). 1988. 19p. Available from US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

A facility to evaluate the fire endurance of mine stoppings was constructed by the Bureau of Mines in the multiple-entry section of the Bruceton (PA) Experimental Mine. Stoppings up to 6 by 8 ft can be tested in a manner simulating mine conditions. The stopping is subjected to a 70-min liquid fuel tray fire with an energy output of 75,000 Btu/min. The stopping and adjacent areas are instrumented with thermocouples and heat flux gauges. Data acquisition is by an automatic data logger capable of continuously recording over 100 channels of information. Two 8-in-thick concrete block stoppings and a galvanized steel stopping were tested. A crack developed on the fire-side surface of the block stoppings where the flames were most intense. However, the temperatures of the unexposed surfaces of the stoppings never exceeded 80^{0}C and the surfaces were undamaged. the steel stopping retained its structural integrity during the test. All stoppings prevented the passage of flame and smoke.

4672 (RI–9214) **Comparison of aerial and ground surveying of subsidence over an active longwall.** LaScola, J.C. Bureau of Mines, Pittsburgh, PA (USA). 1988. 12p. Available from US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

The Bureau of Mines repeatedly surveyed a grid of monuments over an active longwall mine panel in southwestern Pennsylvania during a 1-yr period. Both conventional ground surveying techniques and photogrammetry were used. The objective of this investigation was to compare elevation measurements of subsidence obtained from aerial and ground survey methods under dynamic ground conditions. The results of a statistical analysis of the survey data show that the mean of the differences between 372 matched pairs of elevation measurements was 0.20 ft (61 mm) with a 95-pct-confidence interval of 0.05 ft (15 mm). The mean of the absolute values of the differences was 0.38 ft (116 mm) with a 95-pct-confidence interval of 0.04 ft (12 mm). Ninety-five percent of the absolute values of the differences were less than 1.11 ft (338 mm).

4673 (RI–9218) **Thermal characteristics of energized coal mine trailing cables.** Yenchek, M.R.; Kovalchik, P.G. Bureau of Mines, Pittsburgh, PA (USA). 1988. 12p. Available from US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877.

The Bureau of Mines conducted research to determine the relationship between current load and temperature rises in coal mine trailing cables. Six low-voltage, unshielded, portable power cables were continuously and intermittently loaded with direct current of various magnitudes. Temperature rises within and on the cables were measured with thermocouples, and the data were recorded with a computer. Thermal time constants were calculated, which fixed the periods of the duty-cycle tests. Relationships between average temperature at the conductor-insulation interface and current load were established. The steady-state and intermittent currents that produce a 90^{0}C average conductor-insulation temperature were then determined. Comparisons with Insulated Cable Engineers Association (ICEA) steady-state ratings revealed that 10 to 25 pct more current than recommended ICEA ampacities is required to reach rated insulation temperature.

0170 Legislation and Regulations

Refer also to citation(s) 4619, 4620

02 PETROLEUM

Refer also to citation(s) 4736

4674 (GS–142) **Report of activities, 1988: Resident geologists.** Fenwick, K.G.; Giblin, P.E.; Pitts, A.E. (eds.) Geological Survey of Canada, Ottawa, ON (Canada). 1989. 421p. (MICROLOG–89-04004). Available from PC Ontario Ministry of Natural Resources, Public Information Centre, 99 Wellesley St., W, Toronto, ON, CAN M7A 1W3; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A summary is presented of Ontario oil and gas production and reserves, exploration and development activity, and related research in 1988. The exploration and development of Ordovician reservoirs continued to be the highlight of drilling activity. Development drilling resulted in 24 wells completed as oil producers and 20 as gas producers. Oil production increased dramatically in 1988, and the projection of current figures indicates that total oil production will exceed 190,000 m^3, compared to 135,635 m^3 in 1987. The increase is due entirely to production from new Ordovician reservoirs discovered since 1983. Projected natural gas production is estimated to be 495 million m^3, a 3% decrease from 1987. A major increase in

exploration activity is indicated by the total of nearly 200 wells drilled as compared to 104 in 1987. Research reported includes a long-term subsurface mapping project in Lambton County, a study of Ordovician reservoirs, and an ongoing drill sample storage program. Recommendations for exploration are also presented. 9 refs., 1 fig., 2 tabs.

0202 Reserves, Geology, and Exploration

Refer also to citation(s) 4713

4675 (DOE/EIA–0216(88)) **US crude oil, natural gas, and natural gas liquids reserves: 1988 annual report.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 31 Oct 1989. 107p. Sponsored by U.S. DOE Management & Administration. Order Number DE90003365. Available from NTIS, PC A06/MF A01 - GPO - OSTI; GPO Dep.

This report presents estimates of proved reserves of crude oil, natural gas, and natural gas liquids, as of December 31, 1988, and production volumes for the year 1988 for the total United States and for selected states and state sub-divisions. Estimates are presented for the following four categories of natural gas; total gas (wet after lease separation), its two major components (non-associated and associated-dissolved gas), and total dry gas (wet gas adjusted for the removal of liquids at natural gas processing plants). In addition, two components of natural gas liquids, lease condensate and natural gas plant liquids, have their reserves and production reported separately. Also included is information on indicated additional crude oil reserves and crude oil, natural gas, and lease condensate reserves in non-producing reservoirs. 34 refs., 12 figs., 15 tabs.

4676 (GS–89-1G, pp. 37-42) **A conodont-based thermal maturation study of some Lower and Middle Devonian rocks, northwestern district of Mackenzie and Yukon Territory.** Dougherty, B.J. (Inst. of Sedimentary and Petroleum Geology, Calgary, AB (Canada)); Uyeno, T.T. Geological Survey of Canada, Ottawa, ON (Canada). 1989. (MICROLOG–89-03293). In *Current research, part G. Frontier geoscience program, Arctic Canada.* Available from PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

Thermal maturity maps based on conodont colour alteration indices (CAI) of some Devonian rocks in northwestern Canada are presented. Samples from five Lower Devonian formations outcropping in 19 separate localities in northern Yukon Territory and from four Middle Devonian formations from 261 localities in northwestern District of Mackenzie are plotted. Conodonts from the Lower Devonian samples are dark, with CAI readings of 3.0 or greater. Values of this level suggest that the enclosing rocks are thermally overmature. Trends in CAI readings are not immediately apparent in this structurally complex area. Middle Devonian conodonts are considerably lighter. Their CAI readings can be aligned northwest-southeast the lightest being in the northeast. Samples in the vicinity of the Norman Wells oilfield have a reading of 1.5 to 2.0, which is within the oil window. 15 refs., 3 figs., 4 tabs.

4677 (GS–89-1G, pp. 159-161) **A brief assessment of potential hydrocarbon source rocks of the Canadian Arctic Archipelago.** Goodarzi, F. (Inst. of Sedimentary and Petroleum Geology, Calgary, AB (Canada)); Stewart, K.R. Geological Survey of Canada, Ottawa, ON (Canada). 1989. (MICROLOG–89-03293). In *Current research, part G. Frontier geoscience program, Arctic Canada.* Available from PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

Vitrinite reflectance versus depth profiles have been compiled for a total of 124 boreholes in the Sverdrup and Franklinian basins. Petrology and maturity of 200 Devonian coal samples has also been determined. Good to excellent quality petroleum source rocks occur in four stratigraphic units within the Schei Point Group. Good quality, oil prone source rocks also have been identified in the Jameson Bay Formation (Lower Jurassic) and in the Ranges Formation (Upper Jurassic). The bituminous shales of the Cape Phillips Formation (Upper Ordovician to Lower Devonian) and Eids Formation (Middle Devonian) are the best quality potential hydrocarbon source rocks in the Franklinian Basin. The liptinite-rich coals of Devonian age have a potential to generate hydrocarbons. 17 refs., 1 fig.

4678 (GS–89-1G, pp. 167-176) **Sequence stratigraphy, lithostratigraphy, and hydrocarbon potential of the subsurface upper Paleozoic section of Sabine Peninsula, Melville Island, Canadian Arctic Archipelago.** Majid, A.H. (Inst. of Sedimentary and Petroleum Geology, Calgary, AB (Canada)). Geological Survey of Canada, Ottawa, ON (Canada). 1989. (MICROLOG–89-03293). In *Current research, part G. Frontier geoscience program, Arctic Canada.* Available from PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

Five major depositional sequences are recognized in the subsurface Carboniferous and Permian of southwestern Sverdrup Basin on Sabine Peninsula. The database incorporates descriptions of cores and cuttings from seven wells supplemented by biostratigraphic, log and seismic data to build a stratigraphic and depositional sequence framework extending from a shallow basin margin in the south of Sabine Peninsula to a proximal deeper basin in the central and northern peninsula. Some subsurface refinements are proposed relating to basinal facies in the Trold Fiord and Degerbols formations. Although geochemical data show that the van Hauen and Hare Fiord formations are gas-prone source rocks and are overmature, the possibility of finding oil-prone source rocks still exists. The Canyon Fiord, Assistance and Sabine Bay formations are the most promising reservoir units. The area between the Eldridge and Weatherall wells in the upper and lower parts of the half-graben structures should be investigated to define reservoirs and closures in the upper Paleozoic section. 30 refs., 4 figs., 2 tabs.

4679 (NDE–89-04397) **Hydrocarbon potential of the western Newfoundland offshore area.** Newfoundland Dept. of Energy, St. John's, NF (Canada). Mar 1989. 32p. (MICROLOG–89-04397). Available from PC Newfoundland and Labrador Dept. of Mines and Energy, Geological Survey Branch, PO Box 8700, St. John's, NF, CAN A1B 4J6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

The oil and gas potential of the island of Newfoundland is concentrated in the Humber Zone on the west coast. This zone comprises an area of about 30,000 square km and remains virtually unexplored. It is part of a well-exposed portion of the Appalachian-Caledonian fold belt and is divided into five distinct lithological associations. After describing the regional geology, stratigraphy, and tectonic history of the area, this report outlines the hydrocarbon prospects of the Cambro-Ordovician and Carboniferous sequences found in the zone. Exploration history, source rocks, regional thermal history, reservoirs, and possible traps are described. Although the research on which this report is based has been done on a piecemeal basis, the various studies have identified potential source rocks, reservoir rocks and trapping mechanisms in a number of areas. Conodont alteration studies have shown that much of the region has a thermal history within the oil window. The research has laid the groundwork for the systematic exploration programs that will be required to assess the true potential of the area. 36 refs., 9 figs.

4680 (PB–89-128227/XAB) **Geological and operational summary, North Aleutian Shelf Coast No. 1 well, Bering Sea, Alaska. Final report.** Turner, R.F. Minerals Management Service, Anchorage, AK (USA). Alaska Outer Continental Shelf Region. Nov 1988. 308p. (OCS/MMS–88/0089). Available from NTIS, PC A14/MF A01.

Library of Congress catalog card no. 88-600607.

Discusses the first continental offshore stratigraphic test well drilled in the North Aleutian Basin Planning Area, Bering Sea, Alaska. The well was drilled to determine the hydrocarbon potential of the area. The report covers drilling operations; lithology and core data; velocity analysis; geologic setting and tectonic framework; seismic stratigraphy; well-log interpretation and lithostratigraphy; paleontology and biostratigraphy; geothermal gradient; organic geochemistry; abnormal formation pressure; geologic hazards and shallow geology; and environmental considerations.

4681 (PB–89-237572/XAB) **Outer continental shelf environmental assessment program. Final reports of principal investors. Volume 62.** National Ocean Service, Anchorage, AK (USA). Ocean Assessments Div. Jul 1989. 619p. Available from NTIS, PC A99/MF A01.

See also PB–89-237580, PB–89-237598 and PB–89-234645.

Contents include: natural oil seeps in the Alaskan marine environment; Chukchi Sea coastal studies–coastal geomorphology, environmental sensitivity, and persistence of spilled oil.

0203 Drilling and Production

Refer also to citation(s) 4737, 4738, 4740

4682 (DOE/BC–89/1) **Contracts for field projects and supporting research on enhanced oil recovery: Progress review no. 57, quarter ending December 31, 1989.** USDOE Assistant Secretary for Fossil Energy, Washington, DC (USA). Office of Oil, Gas and Shale Technology; USDOE Bartlesville Project Office, OK (USA). Dec 1989. 82p. Sponsored by U.S. DOE Fossil Energy. Order Number DE89000755. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

Research programs on enhanced recovery of petroleum are briefly presented. A publications list and directory are included. (CBS)

4683 (LA-UR–89-2546) **A hypervelocity projectile launcher for well perforation.** Albright, J.N.; Fugelso, L.E.; Lagner, G.C.; Burns, K.L. Los Alamos National Lab., NM (USA). 1989. 39p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-891214–5: Hypervelocity impact symposium, San Antonio, TX (USA), 12-14 Dec 1989). Order Number DE89015287. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Current oil well perforation techniques use low- to medium-velocity gun launchers for completing wells in soft rock. Shaped-charge jets are normally used in harder, more competent rock. A device to create a much higher velocity projectile was designed. This launcher will provide an alternative technique to be used when the conventional devices do not yield the maximum well performance. It is an adaptation of the axial cavity in a high explosive (HE) annulus design, with the axial cavity being filled with a low density foam material. Two configurations were tested; both had an HE annulus filled with organic foam, one had a projectile. Comparison of the two shots was made. A time sequence of Image Intensifier Camera photographs and sequential, orthogonal flash x-ray radiographs provided information on the propagation of the foam fragments, the first shock wave disturbance, the projectile motion and deformation, and the direct shock wave transmission from the main HE charge. DYNA2D calculations were made to assist in the experimental interpretation. 25 refs., 9 figs.

4684 (LA-UR–89-3582) **A hypervelocity projectile launcher for well perforation.** Fugelso, L.E.; Albright, J.N.; Langner, G.C.; Burns, K.L. Los Alamos National Lab., NM (USA). [1989]. 24p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-891214–7: Hypervelocity impact symposium, San Antonio, TX (USA), 12-14 Dec 1989). Order Number DE90002411. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Current oil well perforation techniques use low- to medium-velocity gun launchers for completing wells in soft rock. Shaped-charge jets are normally used in harder, more competent rock. A launcher for a hypervelocity projectile to be used in well perforation applications has been designed. This launcher will provide an alternative technique to be used when the conventional devices do not yield the maximum well perforation. It is an adaptation of the axial cavity in a high explosive (HE) annulus design, with the axial cavity being filled with a low density foam material. Two configurations were tested; both had an HE annulus filled with organic foam, one had a projectile. Comparison of the two shots was made. A time sequence of Image Intensifier Camera photographs and sequential, orthogonal flash x-ray radiographs provided information on the propagation of the foam fragments, the first shock wave disturbance, the projectile motion and deformation, and the direct shock wave transmission from the main HE charge. Perforation tests of both device configurations (with and without the pellet) into steel-jacketed sandstone cylinders were made. Static radiographs of the cavities in the sandstone showed similar cavities, however, the perforation of the steel can was larger in response to the pellet. DYNA2D calculations were made to assist in the interpretation of the experimental records. The preliminary results show promise that a useful perforating tool can be developed. Plans for an extended experimental program are outlined. 23 refs., 14 figs.

4685 (NIPER–436) **Thermal processes for heavy oil recovery: Status report.** Olsen, D.K. National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA). Sep 1989. 32p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC22-83FE60149. Order Number DE90003759. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This status report summarizes the research conducted in FY89 under each of the three tasks in project BE11B Thermal Processes for Heavy Oil Recovery and completes milestone 4 of this project. Multiple-zone steamflood experiments were conducted using mobility-control agents to divert steam in heavy oil. The effects of temperature on capillary pressure and wettability of heavy oil in sandpacks indicate increasing wettability with temperature. Results of this research include: development of a numerical thermal simulator for laboratory applications; indications that wettability increases with temperature; and evaluation of surfactants and emulsions as steam diverters. A numerical simulator has been developed from fundamental principles to assist in the analysis of laboratory steamflood experiments. 57 refs., 11 figs., 4 tabs.

4686 (NIPER–445) **Development of technology for entrainer-enhanced CO_2 flooding: Status report.** Llave, F.M. National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA). Sep 1989. 24p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC22-83FE60149. Order Number DE90003758. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The results of studies conducted to evaluate the development of the technology for utilizing entrainers for carbon dioxide (CO_2) flooding are described. Experiments were conducted to determine the extent of the fluid-property enhancement (gas-phase density and viscosity) of CO_2 + hydrocarbon and CO_2 + crude oil systems in the presence of selected entrainers (cosolvents). The improvement in CO_2-rich phase hydrocarbon extraction capacity was also determined in the presence of added cosolvents. The hydrocarbon systems used in the study were n-hexadecane and a crude oil sample from Bloomington (TX) field with an API gravity of 22.7°. Preliminary entrainer screening studies were conducted utilizing gas and liquid chromatographic approaches to determine relative affinities of certain cosolvents with target high-molecular-weight hydrocarbon solutes. These solutes ranged in molecular weights from n-decane (n-C_{10}) up to n-tetracontane (n-C_{40}). These qualitative screening methods were useful in identifying potential cosolvents that may be used for future study. A method of utilizing entrainers to enhance the extraction of polymeric materials into the CO_2-rich phase was also investigated. This approach utilized a simple extraction apparatus to determine relative degrees of polymer extraction in CO_2as a function of pressure and the degree of enhancement of extraction in the presence of added cosolvent. 10 refs., 15 figs., 2 tabs.

4687 (OTO–87-007) **Pre-project study for UK Department of Energy on gas solubility in oil based drilling fluids.** Harris, J.G. (British Petroleum Co. Ltd., Sunbury-on-Thames (UK)). Department of Energy, London (UK). Mar 1987. 21p. (DCB–09/87). Available from Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

This report details a study, carried out for the UK Department of Energy (D.En), to determine the need for a gas kick model to investigate and demonstrate the effects of gas solubility in oil-based muds. The report looks at current understanding and identifies areas where knowledge is lacking. It then proposes setting up a joint industry project aimed at improving training and engineering techniques by the use of a mathematical model. (author).

0204 Processing

Refer also to citation(s) 4573, 4710, 4737, 4739, 4741

4688 (CHOA–CE-02645, pp. 13) **Membralox crossflow microfiltration of heavy oil produced water.** Hagen, R.D. (Separ Systems & Research, Ltd. (Canada)); Gramms, L.C. Canadian Heavy Oil Association (Canada). 1988. (CONF-8810454–: Quarterly meeting of the Canadian Heavy Oil Association, Calgary (Canada), 25 Oct 1988; CE–02645). In *Environment & surface facilities challenges. Proceedings [of the] quarterly meeting of the Canadian Heavy Oil Association.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, CAN T5J 3L8. Prices: N/C.

Produced waters from heavy oil production sites contain significant imputities that are costly to remove. Oil/water separation, suspended solids removal, bacteria reduction, and softening can be effectively carried out using crossflow microfiltration. Field pilot studies have demonstrated the application of multi-channel ceramic microfiltration membranes for superior separation of the impurities. It was noted that crossflow microfiltration can remove in excess of 20% oil concentrations to less than 5 mg/l, and suspended solids were reduced from levels of 1% to less than 5 mg/l on a consistant basis. Pretreatment and operation techniques and parameters are reflected in the data. A full scale system is proposed, showing sizing and cost benefits. 4 figs., 3 tabs.

4689 (CHOA–CE-02645, pp. 12) **Operating experience with Saskatchewan Research Council's mobile emulsion treatment mini-plant.** Scoular, R.J. (Saskatchewan Research Council, SK, (Canada)); Mourits, F.M. Canadian Heavy Oil Association (Canada). 1988. (CONF-8810454–: Quarterly meeting of the Canadian Heavy Oil Association, Calgary (Canada), 25 Oct 1988; CE–02645). In *Environment & surface facilities challenges. Proceedings [of the] quarterly meeting of the Canadian Heavy Oil Association.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, CAN T5J 3L8. Prices: N/C.

As an integral part of the heavy oil emulsion research program at the Saskatchewan Research Council, a mobile unit capable of treating 2-10 l/h of emulsion at temperatures up to 100 C and pressures up to 700 kilopascals has been constructed. It has been tested both in the lab and the field and is able to treat produced oil to pipeline specifications. The unit consists of a free water knockout vessel, a heater/treater vessel, and an electrostatic treater. It can be used to provide assistance in optimizing treatment parameters; to test new and promising chemicals, chemical concentrations, and mixing conditions; to evaluate different design and configuration change in conventional emulsion treating equipment; and to test novel emulsion treatment methods and equipment. 5 figs.

4690 (DOE/ER/13843–1) **Electrocatalytic hydrocracking: First year final report.** van der Vaart, D.R. Research Triangle Inst., Research Triangle Park, NC (USA). Nov 1988. 28p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-88ER13843. (RTI–4126). Order Number DE90003723. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The results of the first nine months of DOE Contract entitled "Electrocatalytic Hydrocracking" are presented. Two parallel research efforts were undertaken during this time. The first involved designing and fabricating a reactor system which is suitable for studying electrocatalytic hydrocracking of hydrocarbons to produce high value liquid fuels. In such a system, hydrogen will be supplied to the catalytic surface by electrochemical pumping through the solid proton conducting electrolyte. The second effort focused on the fabrication of a suitable solid electrolyte. To this end, work centered around the optimal process for proton exchanging a commercially available ionic material, β''-Al_2O_3. Using β''-Al_2O_3 from two different manufacturers, a variety of exchange procedures was tested with a successful route being identified. A less well developed electrolyte, $RbNbWO_6$, has also been synthesized which should, when proton exchanged, yield a more thermally stable material. 10 refs., 9 figs.

4691 (FRNC-TH–3554) **Contribution to the study of modeling of atmospheric gas-oil cut cracking testing. Kinetics model.** Zabaniotou, A. Ecole Centrale des Arts et Manufactures, 92 - Chatenay-Malabry (France). Sep 1987. 256p. (In French). Order Number DE90727180. Available from NTIS (US Sales Only), PC A12/MF A01.

A survey of the literature indicated the shortage of experimental and kinetic data especially for the cracking of the atmospheric gas-oil at temperature higher than 600^{0}C. - Experiments were carried out at various temperatures (ranging from 625-800^{0}C), dilution rates (ranging from 1-2) and residence times (ranging from 0.4 to 1 sec). For produced light olefins such C2H4, C3H6, C4H8 the temperatures corresponding to optimum yields were thus located at 800^{0}C, 730^{0}C et 680^{0}C respectively for a dilution rate in the order of 1 and a residence time between 0.5 et 0.7 sec. - Various models for the reaction modelisation of the cracking of the atmospheric gasoil were tested by applying a simulation model to predict the yield of the different products at various temperatures and residence times. The gas-oil was assumed to consist of four principal families of hydrocarbons (paraffins, iso-paraffins, naphtens, aromatics). The reach model that gave the best agreement between the simulated and experimental results consisted of 138 reactions involving 18 species and 24 radicals. This study also indicated that the simulation method applied for the pure hydrocarbons could also provide reliable results for heavier feedstocks and specially for atmospheric gas-oil.

4692 (PB–89-233498/XAB) **Sulfur oxides emissions from fluid catalytic-cracking unit regenerators: Background information for promulgated standards. Environmental impact statement (Final).** Farmer, J.R. Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards. Apr 1989. 157p. (EPA–450/3-82/013B). Available from NTIS, PC A08/MF A01.

Standards of performance to control emissions of sulfur oxides (SOx) from new, modified, and reconstructed fluid catalytic-cracking-unit regenerators are being promulgated under Section 111 of the Clean Air Act. The document contains a summary of public comments, EPA responses, and a discussion of differences between the proposed and promulgated standard.

4693 **Method of producing pyrolysis gases from carbon-containing materials.** Mudge, L.K.; Brown, M.D.; Wilcox, W.A.; Baker, E.G. To Battelle Memorial Inst., Richland, WA. USA Patent 4,865,625. 12 Sep 1989. Filed date 2 May 1988. USA Patent Application 7 189,419. Int. Cl. C10J 3/84;C10K 3/02. vp Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a method for producing pyrolysis gases from carbon-containing materials. The method comprising: pyrolyzing the carbon-containing materials in a gasification reactor in order to form pyrolysis gases therefrom. The pyrolysis gases having residual tar and oil byproducts entrained therein; passing the pyrolysis gases from the gasification reactor into and through a catalytic reactor having a fluidized bed therein for eliminating the tar and oil byproducts from the pyrolysis gases, the catalytic reactor being maintained at a temperature of about 550^0-750^{0}C and containing at least one catalyst therein; and introducing a gaseous oxidizing agent selected from the group consisting of air, oxygen, steam, and mixtures thereof into the catalytic reactor. The gaseous oxidizing agent being introduced into the catalytic reactor and released into the bed of the catalytic reactor in a direction perpendicular to the longitudinal axis of the reactor. The oxidizing agent being introduced at a flow rate sufficient to impart a swirling motion to the catalyst in the catalytic reactor in order to react with any deposited carbon on the catalyst to enable the oxidation and removal of the carbon therefrom.

4694 **Soluble silylated polyacetylene derivatives and their use as percursors to novel polyacetylene-type polymers.** Ziegler, J.M. To U.S. Dept. of Energy, Washington, DC. USA Patent 4,866,147. 12 Sep 1989. Filed date 22 Sep 1986. USA Patent Application 6 909,801. Int. Cl. C08F 28/06;C08F 130/08;C08F 230/08. vp Available from Patent and Trademark Office, Box 9, Washington, DC 20232.

This patent describes a soluble polymer or copolymer having -$C(R)=C(R)_4$- as a majority of repeating structural units and a molecular weight $M_{wts} \geq$ about 10,000. The polymer or copolymer being the product of the polymerization of acetylenic monomers at a temperature within the range of -10^0 to 150^{0}C in an inert atmosphere and in the presence of a tungsten (III or IV) compound and a cocatalyst selected from the group consisting of organolithium

compounds, organomagnesium compounds, polysilanes, and compounds containing a Si-Si, P-P, S-S, Ge-Ge, As-As, Sn-Sn, Sb-Sb, or Te-Te bond. The acetylenic monomers having the formula R-C(R)=C(R)$_4$, wherein R is $R_1R_2R_3Si$, in which eacy R^1, R_2, and R_3 is C_{1-4}-(eta- or sec-)alkyl, C_{2-4}-alkenyl, C_{6-14}-aryl, C_{7-17} heteroaryl, C_{7-17}-alkaryl, C_{7-17}aralkyl, C_{3-12}-cycloalkyl, C_{2-4}-(eta- or sec-)-alkyl wherein one CH_2 group is replaced by -O-, -S-, -COO-, or -OOC-; H, or groups recited for R_1, R_2, and R_3; R_4 is H or one of the groups recited for R_1, R_2, and R_3 except C_{2-4}-alkenyl, with the provisos that R and R_4 must not both be H at the same time and that the combination of R and R_4 be sterically compatible with the polymerization.

0205 Products and By-Products

Refer also to citation(s) 4580, 4700, 5389, 5392

4695 (AD-A-211300/9/XAB) **Program to evaluate a vehicle test method for port fuel-injector deposit-forming tendencies of unleaded base gasolines.** Coordinating Research Council, Inc., Atlanta, GA (USA). Feb 1989. 111p. (CRC–565). Available from NTIS, PC A06/MF A01.

Car owners complaining of operability problems with port-fuel injector (PFI) systems late in 1984. Deposits within the tips of the pintle-type injectors of certain engines restricted fuel flow and caused misfiring. The automakers and gasoline marketers sought a test method that would enable determination of causative factors and consequent solutions. The Coordinating Research Council (CRC) Automotive Fuel-Injector Deposit Group, organized in March 1986, developed a program which led to selection of a vehicle procedure for a round-robin evaluation. The cycle involved 15 minutes operation at 88 kph (55 mph) followed by a 45-minute hot-soak shutdown with total test durations of 4800 to 9600 km (3000 to 6000 miles). Twelve laboratories ran various combinations of three-different base unleaded gasolines in five types of port-fuel-injected engines. From this set, data from 38 runs were analyzed, representing eleven laboratories and four engine types. Even though all test conditions were not tightly controlled, results showed statistically significant differences (at the 95% confidence level) in deposit-forming tendencies of the fuels as well as the vehicles. The test approach is useful for relative performance evaluations, but more development effort is needed before it could serve as a quantitative measure.

0207 Economic, Industrial, and Business Aspects

Refer also to citation(s) 4716, 4717, 5272, 5275, 5283

4696 (DOE/CH/10348–1, pp. 31-48) **The oil industry perspective.** Wise, J.J. Illinois Univ., Chicago, IL (USA). Energy Resources Center. 1987. (CONF-8711295–: 15. annual Illinois energy conference: transition to an energy secure economy, the changing economic and regulatory scene, Chicago, IL (USA), 10-11 Nov 1987). In *Transition to an energy secure economy: The changing economic and regulatory scene. Proceedings.* Order Number DE89008864. Available from NTIS, PC A09/MF A01.

The need and use of new technologies to increase and extend the use of recoverable oil reserves is discussed. Oil accounts for 43% of total US energy demand, while natural gas and coal each provide 23%, nuclear 6%, and hydro and other sources 5%. Transportation fuels account for 63% of the US oil demand. Economically recoverable domestic oil is scarce, harder to find, and refine. Exploration is required in hostile and remote environments with high costs. Infrared satellite imaging provide clues to potential oil- or gas-bearing strata. Seismic imaging uses powerful sources to bounce waves off rocks miles below the surface. Ocean going ships with air guns generate sound waves to map several miles of sub surface formations every hour. Supercomputers analyze and display three dimensional images of reservoirs as small as 20 to 30 feet thick several miles underground. Streams of subatomic particles are injected to locate new hydrocarbon zones. Medical type CAT scanners measure porosity in core samples. About 300 billion barrels, two-thirds of the oil ever discovered in North America is still in the ground. Recovering 2% of this trapped oil would be equivalent to another Alaskan Prudhoe Bay. Current technology can recover about 20.5 billion barrels of trapped light oil. More advanced technology and higher prices could add another 56 billion barrels of light oil to recoverable reserves. A similar situation exists for about 15 billion barrels of heavy oil. Shale oil with an 80 billion barrel potential is a long term prospect. New technology includes; horizontal drilling, carbon dioxide miscible flooding, steam flooding with foam injection and computerized reservoir simulators. Compliant type platforms will replace rigid platforms to provide safer and more effective deep water recovery. Improved refining technology improves the potential for use of heavy oils.

4697 (PCPP/R–89-03949) **Petro-Canada annual report.** Petro-Canada Products, Sheridan Park, ON (Canada). Research and Development Centre. 1988. 62p. (MICROLOG–89-03949). Available from PC Petro-Canada, P.O. Box 2844, Calgary, AB, CAN T2P 3E3; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

Petro-Canada is Canada's national energy corporation, formed by an Act of Parliament in 1975 and wholly owned by the Government of Canada. Operations began on January 1, 1976. The company operates in a commercial fashion, competing in the oil and gas industry on the same basis as other integrated oil companies. It is the largest Canadian-owned oil and gas company, with assests over $8.5 billion and revenue in 1988 of almost $5 billion. This annual report gives a corporate profile, a statement of corporate responsibility, and reports on the year's activities in production and sales of natural gas, synthetic and natural crude oil and gasoline. The report also gives details of Petro-Canada's involvement in East Coast offshore oil development, including a Hibernia statement of principles. A financial review from 1984 to the present is included, along with a glossary of financial terms, a financial statement, and a 5-year summary. Reserves information commparing the current to the previous year is given. 16 figs.

4698 (PMA–CE-02772) **Canadian petroleum industry, 1988 monitoring report.** Petroleum Monitoring Agency, Ottawa, ON (Canada). 1989. 91p. (CE–02772). Available from Petroleum Monitoring Agency, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: N/C.

The Petroleum Monitoring Agency was in 1980 to provide the federal government with comprehensive and objective information and analysis of the financial peroformance of the petroleum industry in Canada. The agency's reports are based on information received directly from all but the smallest oil and gas companies. New aspects in this year's report are: crude oil and marketable natural gas volumes together with their respective average prices; and a new definition of operating costs which includes general and administrative expenses. The subjects covered in this report are: financial performances, sources and uses of funds, comparative performance of the petroleum industry and other industries, ownership and control trends, research and development activities, and a 10 year operating summary. The overall net income of the industry declined by 27% during 1988 to $2.4 billion; the average prices for crude oil and natural gas dropped to their lowest levels in nearly a decade. However, with improved cash flow in 1987, optimism about future prices and new government inventives encouraged the industry to commit itself in 1988 to increased capital outlays, up by 19% or $1,4 billion. The time delays so typical of this industry resulted in a 20% rise in the reinvestment rate to 95%. However, early reports for the first half of 1989 indicate a decline in this rate due to a decrease in captial spending. A glossary of terms is provided. 11 figs., 17 tabs.

0208 Waste Management

Refer also to citation(s) 4688, 4737, 4739, 4747

0209 Environmental Aspects

Refer also to citation(s) 4692, 5241, 5826

4699 (AI/N–89-02740) **Come-by-Chance refinery site remediation: Final report.** Acres International Ltd., St. John's, NF (Canada). 1987. 178p. (MICROLOG–89-02740). Available from PC Dept. of Environment and Lands, Elizabeth Towers, Elizabeth Ave.,

P.O. Box 4750, St. John's, NF, CAN A1C 5T7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

From 1973 until closure of the plant in 1976, a petroleum refinery was operated at Come-by-Chance in Newfoundland. During this time, 2 unregulated sites in the general vicinity of the plant were apparently used largely for the disposal of construction waste, while a third site was used to store full and empty drums of refinery chemicals. This report is about a hydrogeological investigation of these 3 sites conducted in order to assess pollution and the impact of pollution on the environment and in order to recommend any remedial works required to eliminate site hazards to the environment. The 5 steps of the investigation were the following: preliminary hydrogeological/geotechnical survey of each site; assessment of the extent of contamination and seepage of any chemicals from each site; chemical sampling and analysis to confirm the type, concentration and extent of any chemicals in the soil and ground water; evaluation of each site in terms of impacts in the environment in-site and off-site; and recommendations about remedial measures. The cost of the recommended remedial measures, including the monitoring of ground water, is expected to be $400,000. 7 refs., 9 figs., 13 tabs.

4700 (PB–89-219976/XAB) **In-situ bioremediation of spills from underground storage tanks: New approaches for site characterization project design, and evaluation of performance. Final report, 1985-1989.** Wilson, J.T.; Leach, L.E.; Michalowski, J.; Vandegrift, S.; Callaway, R. Environmental Protection Agency, Ada, OK (USA). Robert S. Kerr Environmental Research Lab. Jul 1989. 62p. (EPA–600/2-89/042). Available from NTIS, PC A04/MF A01.

This report presents a systematic approach for the design of in-situ bioremediation of hydrocarbon contamination in ground water from the determination of the total quantity of hydrocarbons in the aquifer to the utilization of that information in an actual field bioremediation demonstration. This report explains why the total quantity of hydrocarbons in an aquifer can only be determined by collecting cores. A procedure to acquire cores from a contaminated aquifer is described. The procedures described in the report were field-tested in designing a demonstration of the bioremediation of an aviation-gasoline leak. The performance of the demonstration was consistent with the expected performance based on the preliminary site characterization using the described procedures.

4701 (PB–89-234892/XAB) **Gulf of Mexico sales 123 and 125: Central and western planning areas. Draft environmental impact statement.** Minerals Management Service, Metairie, LA (USA). Gulf of Mexico OCS Regional Office. Mar 1989. 439p. (MMS/GM–89/0005). Available from NTIS, PC A19/MF A01.

See also PB–89-114185 and PB–89-234900.

The EIS draft is a description of the environmental aspects and impacts of oil and gas activities resulting from the lease sales or the states bordering the Gulf of Mexico. It provides a description of the areas, the affected environment, and the environmental consequences; it discusses the proposed actions, issues and areas of concern, and the major differences of holding the lease sales.

4702 (PB–89-234900/XAB) **Gulf of Mexico sales 123 and 125: Central and western planning areas. Final environmental impact statement.** Minerals Management Service, Metairie, LA (USA). Gulf of Mexico OCS Regional Office. Aug 1989. 492p. (MMS/GM–89/0053). Available from NTIS, PC A21/MF A01.

See also PB–89-234892.

This EIS draft is a description of the environmental aspects and impacts of oil and gas activities resulting from the lease sales or the states bordering the Gulf of Mexico. It provides a description of the areas, the affected environment, and the environmental consequences; it discusses the proposed actions, issues and areas of concern, and the major differences of holding the lease sales.

4703 (PB–89-237598/XAB) **Chukchi Sea coastal studies: Coastal geomorphology, environmental sensitivity, and persistence of spilled oil. Final report.** Robilliard, G.A.; Harper, J.R.; Isaacs, J.; Foget, C. Woodward-Clyde Consultants, Walnut Creek, CA (USA). Mar 1985. 489p. Available from NTIS, PC A99.

This report: Describes the physical and biological characteristics of the northern Chukchi Sea coastline, emphasizing shore characteristics that influence the effect of oil spills or that are likely to be affected by oil spills; Describes and maps the level of oil persistence along the shoreline; Describes and maps the vulnerability and sensitivity of selected coastal biological resources to spilled oil; Describes and maps the sensitivity of selected human uses of the shoreline to spilled oil; Describes the cleanup techniques and equipment available for use in arctic conditions and recommends appropriate shoreline countermeasures.

4704 (TC–T1-8-1988) **Maritime Pollution Claims Fund annual report, 1987-1988.** Transport Canada, Ottawa, ON (Canada). Research and Development. 1989. 9p. (MICROLOG–89-02896). Available from PC Transport Canada, Library and Information Centre, Place de Ville, Tower C, Ottawa, ON, CAN K1A 0N5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This annual report presents a summary of the actions in which the Fund has been involved, outstanding claims from previous years, amendments to the Canada Shipping Act, and the status of the Fund, including payments out. Actions reported on include oil discharges at Saint John, New Brunswick; near Chandler, Quebec; near Point Pelee, Ontario; near Matane, Quebec; in Lake Superior near Michipicoten, Ontario; and at Come by Chance, Newfoundland.

0220 Transport, Handling, and Storage

4705 (NRC/ACP–89-03549, pp. 16) **In the western division of Venezuela gas turbine maintenance experience.** Lagoven, S.A. National Research Council of Canada, Ottawa, ON (Canada). Associate Committee on Propulsion. Sep 1987. (CONF-8709481–: 7. National Research Council of Canada (NRCC) symposium on industrial application of gas turbines, Banff (Canada), 27-30 Sep 1987; MICROLOG–89-03549). In *Proceedings [of the] seventh NRCC [National Research Council of Canada] symposium on industrial application of gas turbines.* Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Lagoven is one of the affiliates of the Venezuelan state petroleum company and its western division has a production potential of 37% of the national capacity. In this division, the gas turbine is the principal prime mover, taking advantages of the large natural gas resources to provide power for the transport and compression of oil and gas, and for electric power generation. A total of 102 turbines of over 10 models from various manufacturers are being used, the first turbine having been installed in 1954. To allow continuous service, mostly in unattended operation, a maintenance program involving failure prevention as well as diagnostics and repair services has been implemented. A certain amount of redundancy has been built into the gas compression, waterflood, power, and oil pumping systems to compensate for unavailability of critical units being repaired. In-house services, including a large central maintenance workshop, are provided due to the relative isolation of Venezuela from reliable sources of maintenance services. Personnel include a field maintenance organization; an operational organization for data collection, control, and planning of maintenance; and an engineering support team that maximizes the availability and efficiency of the facilities, deals with critical and recurrent problems, and introduces new technologies. Three types of maintenance are carried out: preventive (statistically based), predictive (condition based), and corrective. Experiences in each of these areas are summarized.

4706 (OTO–88-0144) **Further period in the development of an expert system for assessment of corrosion risks on offshore submarine pipelines.** Department of Energy, London (UK); Cranfield Inst. of Tech., Bedford (UK). Marine Technology Centre. Jun 1988. vp.Project PEN-K-2028. Available from Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

This report summarises the work performed during the extension to the EXPRES Project. During this period three major tasks were undertaken, namely a user manual was produced to allow external

users to operate the EXPRES system whilst it is maintained on the Cranfield Institute Vax computers; a method for tracing the reasoning of the Expert System and recording that trace in a manner which showed what had been considered by the system when it reached a conclusion was developed; and the EXPRES system was translated from the POPLOG development environment to another more readily available programming language with scope for subsequent implementation across a range of computers. (author).

0230 Properties and Composition

Refer also to citation(s) 4694

4707 (DOE/PC/88827–T4) **Thermal stability of jet fuel: Fourth quarterly report, July–September 1989.** Eser, S.; Perison, J.; Copenhaver, R.M.; Schobert, H.H. Pennsylvania State Univ., University Park, PA (USA). Coll. of Earth and Mineral Sciences. 1989. 54p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88827. Order Number DE90002760. Available from NTIS, PC A04/MF A01 - OSTI.

The overall objective of this program is to investigate the effect of chemical components on the thermal stability of jet fuel. Six model compounds have been heat treated in microautoclave reactors lined with pyrex tubes to investigate the effect of the reactor surface on thermal degradation reactions. These experiments were carried out at 350–450°C for 1–2 hours in 100 psig cold nitrogen pressure. Reactions products were analyzed by ^{1}H and ^{13}C NMR spectroscopy to compare their chemical constitution with those obtained under the same conditions without the glass liners in the reactors. The thermal treatments in air were extended to cover a wider temperature and time range than those indicated in the second quarterly report. The treatment temperature varied between 150 and 450°C for reaction times ranging from 93 hours to 1 hour, respectively. This set of reactions were performed under 100 psig cold air pressure. Reaction products were characterized by ^{1}H and ^{13}C NMR spectroscopy and GC-MS analysis. The degradation of 2,6-dimethylphenol is discussed. 22 figs., 1 tab.

4708 (EPRI-GS–6570) **Methods for assessing the stability and compatibility of residual fuel oils: Final report.** Anderson, R.P. (National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)); Reynolds, J.W. Electric Power Research Inst., Palo Alto, CA (USA); National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA). c Nov 1989. 189p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The declining quality of residual fuel oil is of significant concern to residual fuel oil users in the electric utility industry. This project was concerned with the specific problems of instability (sediment formation or viscosity increases) and incompatibility (formation of sediment on blending with another fuel or cutter stock) which can adversely affect the fuel storage and handling systems. These problems became more severe in the late 70's and early 80's with the decline in quality of refinery feedstocks and an increase in severity of processing for conversion of resid to distillate products. Current specifications and quality control tests are inadequate to prevent or even predict problems due to instability or incompatibility. The objective of this project was to evaluate/develop rapid simple tests which utilities can use to anticipate and prevent problems from instability/incompatibility. 22 refs., 23 figs., 23 tabs.

4709 (SAND–89-1238C) **Methods development for trace metal characterization of crude oil by Inductively Coupled Plasma Atomic Emission Spectroscopy.** Gonzales, M. (Sandia National Labs., Albuquerque, NM (USA)); Lynch, A.W. Sandia National Labs., Albuquerque, NM (USA). [1989]. 17p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC04-76DP00789. (CONF-891245–1: ASTM symposium on modern instrumental methods of elemental analysis of petroleum products and lubricants, New Orleans, LA (USA), 11-13 Dec 1989). Order Number DE90001503. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This study was done to determine if the sensitivity and accuracy of the ICP analysis could be maintained while using direct injection of diluted oil. The first part of this study included compilation of a list of elements that could be of environmental and operational concern to refinery operators. The list contains not only naturally occurring metals normally considered to be major catalyst and/or product contaminants (i.e. Cu, V, Ni, Fe), but also those elements that may enter the system as a contamination from a source such as an inadequately cleaned tank that was used to transport the oil. The spectral wavelengths used for analyses of these selected elements were chosen by incorporating a scanning technique that identified any cross-element interferences. We were also able to monitor the sensitivity, peak profiles and baseline resolution of these candidate wavelengths. Other factors, such as the effects of viscosity and diluents, were also addressed. 7 refs., 1 fig., 5 tabs.

4710 **Characterization studies on visbreaker residues and bitumens.** Giavarini, C. (Rome Univ. (Italy)); Maregrande, S. *Fuel Science and Technology International (USA)*, 7(8): 1121-1138 (1989).

To better characterize the visbreaker (VB) residues and bitumens, and to study the differences between visbreaker and straight run (SR) products, four groups of samples (VB and SR residues and bitumens) were produced in some italian refineries. The samples were tested and analyzed in order to know their viscosity at various temperatures, and their composition (chemical analysis and nmr). Adhesion, stability to oxidation, flow resistance of asphalt concrete were also evaluated for the bitumens. The study showed that nmr-aromaticity of the visbreaker residues and bitumens was increased by the visbreaking operation. Visbreaker bitumens were sensitive to oxidation and gave higher Marshall resistances. The susceptibility of penetration and viscosity to temperature changes was higher for visbreaker bitumens.

03 NATURAL GAS

4711 (CGPA–CE-02784) **Expanded markets: Meeting the challenge and avoiding the pitfalls.** Canadian Gas Processors Association, Calgary, AB (Canada); Canadian Gas Processors Suppliers Association, Calgary, AB (Canada). 1988. vp (CONF-8811293–: Plant operating, maintenance and production conference, Calgary (Canada), 17 Nov 1988; CE–02784). Available from Info-Tech (Div. Of Maclean Hunter Ltd.), Suite 200, 1015 Centre Street North, Calgary, AB, CAN T2E 2P8. Prices: $35.00 CAN.

A conference was held in Alberta on various aspects of natural gas plant operations. Papers were presented on permit applications, industry-community relations, pipeline allocations and other transportation-related issues, maintenance planning systems, gas field optimization, and computerized control and data acquisition systems. Separate abstracts have been prepared for 8 papers from this conference. 8 conf. papers

4712 (CGPA–CE-02784, pp. 16) **Maintenance planning systems.** Turner, D.G. (Delta Projects, Inc., Calgary, AB (Canada)); Davey, B.C. Canadian Gas Processors Association, Calgary, AB (Canada); Canadian Gas Processors Suppliers Association, Calgary, AB (Canada). 1988. (CONF-8811293–: Plant operating, maintenance and production conference, Calgary (Canada), 17 Nov 1988; CE–02784). In *Expanded markets: Meeting the challenge and avoiding the pitfalls.* Available from Info-Tech (Div. Of Maclean Hunter Ltd.), Suite 200, 1015 Centre Street North, Calgary, AB, CAN T2E 2P8. Prices: $35.00 CAN.

This paper outlines an established maintenance planning and execution methodology as used in the natural gas and related industries. Guidelines are presented for planning and executing of a maintenance turnaround in which the utilization of computer technology can be of significant help. A computerized planning package based on the outlined approach is presented, known as CASP ™. This package has proved to help management achieve safe, cost effective and timely execution of turnarounds. To date, the benefits, in terms of quantifiable profitability improvements, have not been fully substantiated; however, a 30% reduction in planning effort has been experienced.

0302 Reserves, Geology, and Exploration

Refer also to citation(s) 4675, 4680, 4681

4713 (CERI–86-2) **Reserves of hydrocarbons in Alberta: A review of Canadian Petroleum Association and Alberta Energy Resources Conservation Board estimates and methodology.** Tanner, J.N. Canadian Energy Research Inst., Calgary, AB (Canada). Nov 1986. 130p. (CE–02779). Available from PC Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $25.00 CAN; MF $10 CAN.

This study is designed as a handbook for those engaged in the use and analysis of petroleum and natural gas reserves data. A discussion of the mechanics of reserves estimation and of the various techniques and definitions underlying the assessment of hydrocarbon reserves provides the analyst with an understanding of the methodology upon which reserves estimates are based. The study focuses on the hydrocarbon reserves estimates generated for Alberta by the Alberta Energy Resources Conservation Board and by the Canadian Petroleum Association. These organizations provide hydrocarbon reserves estimates for Alberta dating from the beginning of active oil and gas development in the province. Historical differences between the two reserves series are identified and discussed, with explanations for the differences provided where possible. The most recent (1986) reserves estimates generated by the two organizations for the various hydrocarbon categories are the following: conventional crude oil, 648.5 and 648.7 Mm^3; natural gas liquids, 144.0 and 163.9 Mm^3; bitumen in situ, initial established, 72.2 and 146.1 Mm^3 bitumen in situ, remaining established, 59.6 and 136.5 Mm^3;oil sands, 282.0 and 256.2Mm^3; sulfur, 76.8 and 83.4 Mtonnes; marketable natural gas, 1,768.3 and 1,827.1 Gm^3. In conclusion, recommendations are provided regarding the future estimation of hydrocarbon reserves, in particular, that the established reserves definition be maintained. Terminological questions pertaining to natural hydrocarbons, hydrocarbons reserves and hydrocarbons recovery are settled in attachment 2 and appendix F of this study. 9 refs., 24 figs., 17 tabs.

0303 Drilling, Production, and Processing

Refer also to citation(s) 4687, 4725

4714 (CGPA–CE-02784, pp. 12) **Optimization of a gas field.** King, R.D. Canadian Gas Processors Association, Calgary, AB (Canada); Canadian Gas Processors Suppliers Association, Calgary, AB (Canada). 1988. (CONF-8811293–: Plant operating, maintenance and production conference, Calgary (Canada), 17 Nov 1988; CE–02784). In *Expanded markets: Meeting the challenge and avoiding the pitfalls.* Available from Info-Tech (Div. Of Maclean Hunter Ltd.), Suite 200, 1015 Centre Street North, Calgary, AB, CAN T2E 2P8. Prices: $35.00 CAN.

Operational optimization of a gas field is illustrated by using the example of the Westerose South field in Alberta. A general turndown plan was prepared to establish the operational and design requirements of the entire operating system for the flow conditions expected through the entire turndown range. The main considerations of this plan were the flow, pressure, temperature, and velocity. Once this plan was in place, the individual operating units (field, wells, well laterals, gathering system, inlet separation and compression, and gas plant) could be optimized within the limitations of the overall plan. A history is provided of the optimization events from the 1961-1974 non-decline stage, through the 1975-78 pressure decline stage, to the later stages of flow and pressure decline. Optimization of the entire system has maintained operating efficiency over the entire range of conditions with minimum operational problems. The turndown plan has shown effectiveness in controlling the individual unit optimization strategies, enabling engineering design work to occur well before actual needs. The plan has provided a means of forecasting excess capacities so that processing commitments could be made. 5 figs.

0304 Products and By-Products

Refer also to citation(s) 5389

0306 Economic, Industrial, and Business Aspects

Refer also to citation(s) 4646, 4697, 4698, 5269, 5273, 5390, 5391

4715 (CERI–30) **Industrial natural gas demand.** Heggelund, M. Canadian Energy Research Inst., Calgary, AB (Canada). May 1989. 280p. (CE–02776). Available from Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6. Prices: $75.00 CAN.

This study outlines some key developments on the demand side of the market of natural gas in Canada. Specifically, it provides a comprehensive overview of likely long-term trends in Canadian industrial natural gas demand. Concentrating on the five largest natural gas using manufacturing industries, namely, pulp and paper, iron and steel, petroleum refineries, industrial chemicals and fertilizers, the study provides a detailed description of the industrial processes involved, and thereby an understanding of their energy end-use requirements. To predict how these energy use patterns will evolve over time, it is necessary to assess final product demand as well as the evolving process technologies for each industry. A number of regional process and end-use models and data bases from across Canada were examined for the purpose of developing such industrial scenarios. A comprehensive, national modelling framework was then employed to forecast long-term natural gas requirements for each of these major industries, and for the entire industrial sector. Because of the required detail and the long-term aspect of the forecast, a description of the capital equipment in use and a discussion of technological change for these industries has been included. The study reached the following conclusions: technological changes in production processes can substantially reduce the growth in total energy demand of the industrial sector and that natural gas suppliers should enhance their efforts in the research and development of efficient natural gas-based production technologies and should realize the important potential impact of cogeneration technologies. A glossary of technical terms is provided. 171 refs., 50 figs., 53 tabs.

4716 (CERI–88-1) **Oil and gas finding costs in Alberta: 1970-1986.** Pasay, J.L. Canadian Energy Research Inst., Calgary, AB (Canada). May 1988. 53p. (CE–02777). Available from Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6. Prices: $10.00 CAN.

Finding cost data are useful for planning purposes, to assist in identifying the most potentially profitable areas to explore and also for management purposes, to evaluate the success of an individual company. This report provides revised estimates of oil and gas finding costs in Alberta using updated data. The method employed in the finding cost calculations is explained. Finding cost estimates for Alberta for the 1970 to 1986 period are given. Crude oil equivalent finding costs continue the overall upward trend noted in earlier reports. Crude oil equivalence is calculated on the basis of 9.61 thousand normal cubic feet of natural gas to one barrel of crude oil; the 3-year moving average base case result is $9.15 per barrel of oil equivalent in 1986. The same trend is evident in the results when separate crude oil and natural gas finding costs are calculated. In the preferred case, 3-year moving average crude oil finding costs show a general increase over time with significant peaks in 1972, 1976, and 1981; the 1986 result is $9.75 to $11.55 per barrel. The natural gas 3-year moving average finding costs increase steadily to 1982 decline to 1985, and then increase sharply in 1986 to a level of 45 to 55 cents per thousand cubic feet. Any estimate of hydrocarbon finding costs must be evaluated in light of the methodology and assumptions used in their calculaton. Further analysis in the area of finding costs will include extending the results to an analysis of full cycle costs, incorporating development and production expenditues as well as exploration expenditures. 7 refs., 9 figs., 24 tabs.

4717 (CERI–89-1) **Oil and gas finding costs in Alberta: 1970-1987.** McLachlan, M. Canadian Energy Research Inst., Calgary, AB (Canada). May 1989. 53p. (CE–02778). Available from Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6. Prices: $30.00 CAN.

Finding cost data are useful for planning purposes, to assist in identifying the most potentially profitable areas for exploration and also for management purposes, to evaluate the success of an individual company. This report provides revised estimates of oil and

gas finding costs in Alberta using updated data. The method employed in the finding cost calculations is explained. Finding cost estimates for Alberta for the 1970 to 1987 period are given. Crude oil equivalent finding costs continue the downward trend which began in the early 1980s; the 3 year moving average finding cost estimate for 1987 is $4.53 to $5.52 per barrel of oil equivalent. The same downward trend appears when separate crude oil and natural gas finding costs are calculated; the 3-year moving average estimate of crude oil finding costs in 1987 is $7.06 to $8.62 per barrel; the 3-year moving average of 1987 natural gas finding costs is $0.21 to $0.26 per thousand normal cubic feet, or $2.47 to 3.03 per barrel of oil equivalent. The downward trends in finding costs is the result of a compensation between opposite factors. 2 refs., 7 figs., 25 tabs.

4718 (CONF-8910162–5) **Pricing and optimal capacity with economies of scale: Implications for gas pipeline expansion to serve New England.** Hanson, D.A. (Argonne National Lab., IL (USA)); Bassett, G.W. Jr. Argonne National Lab., IL (USA). [1989]. 13p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. From 11. annual North American conference of the International Association for Energy Economists; Los Angeles, CA (USA); 16-18 Oct 1989. Order Number DE90003809. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper develops a general theory of optimal capacity with economies of scale and describes the relationships among pricing, sales, and optimal capacity. Although there may be numerous applications for this theory, this paper discusses the application to natural gas pipelines and, in particular, the problem of expanding capacity to serve the New England market. 7 refs., 3 figs.

4719 (DOE/EIA–0130(89/09)) **Natural gas monthly, September 1989.** USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas. 21 Nov 1989. 161p. Sponsored by U.S. DOE Management & Administration. Order Number DE90003691. Available from NTIS, PC A08/MF A01 - GPO - OSTI; GPO Dep.

The NGM highlights activities, events, and analyses of interest to public and private sector organizations associated with the natural gas industry. Volume and price data are presented each month for natural gas production, distribution, consumption, and interstate pipeline activities. Producer-related activities and underground storage data are also reported. From time to time, the NGM features articles designed to assist readers in using and interpreting natural gas information. 6 figs., 33 tabs.

4720 (EIU-SR–1144) **Natural gas in Western Europe: Economic or managed markets?.** Cox, L. Economist Intelligence Unit, London (UK). Jul 1988. 48p. Available from Available from the British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The evolution of natural gas markets in Western Europe over the past two decades is the subject of this Special Report. The aim is to demonstrate how this evolution has created both opportunities and problems, and how it has shaped the perspectives of policy makers to this day. The major premises of this paper are: natural gas is in abundant supply in all West European markets; markets available to natural gas are also available to other fuels, and to competition between suppliers of natural gas itself; the diversity of supply sources limits the risk of political disruption; contrary to the belief of some observers, for the next several years there will be an excess deliverability of natural gas, a market situation which should reduce prices and encourage development of new transmission systems - if policies so allow; and such development will not come about without much freer access to transportation by end users and producers. (author).

0308 Environmental Aspects

Refer also to citation(s) 4701, 4702, 5826

4721 (CGPA–CE-02784, pp. 17) **Corporate philosophies on public involvement.** Gorby, R. (Shell Canada Ltd., Calgary, AB (Canada)). Canadian Gas Processors Association, Calgary, AB (Canada); Canadian Gas Processors Suppliers Association, Calgary, AB (Canada). 1988. (CONF-8811293–: Plant operating, maintenance and production conference, Calgary (Canada), 17 Nov 1988; CE–02784). In *Expanded markets: Meeting the challenge and avoiding the pitfalls.* Available from Info-Tech (Div. Of Maclean Hunter Ltd.), Suite 200, 1015 Centre Street North, Calgary, AB, CAN T2E 2P8. Prices: $35.00 CAN.

This paper examines the characteristics of a successful community information program related to proposing and operating a natural gas processing plant. Factors inherent in a community that will affect its response to a project with environmental implications are considered. Pro-active programs for achieving resident and landowner input are discussed, and comments are made on the characteristics and approach of industry, government, and environmental consulting staff desirable for quality work in this area. The purpose of public meetings and other contacts is reviewed and a few under-utilized communication tools noted. It is concluded that successful community interaction in resource project environmental planning is achievable now and in the future if the task is given the dedication and commitment required.

4722 (CGPA–CE-02784, pp. 12) **When industry comes to town.** Brown, R. Canadian Gas Processors Association, Calgary, AB (Canada); Canadian Gas Processors Suppliers Association, Calgary, AB (Canada). 1988. (CONF-8811293–: Plant operating, maintenance and production conference, Calgary (Canada), 17 Nov 1988; CE–02784). In *Expanded markets: Meeting the challenge and avoiding the pitfalls.* Available from Info-Tech (Div. Of Maclean Hunter Ltd.), Suite 200, 1015 Centre Street North, Calgary, AB, CAN T2E 2P8. Prices: $35.00 CAN.

With a major development such as the Caroline Swan Hills gas field (Alberta), there are many impacts on a small community. The advantages include growth, employment, and new business opportunities. Disruption of lifestyle represents degrees of disadvantages to various members of the population. Any industry moving into an area must deal with a corporate image that will precede it. Corporations are generally perceived as being big, powerful, and dishonest. Any problems occurring with the industry in the past will be well-remembered. A good public relations program can go a long way to change the image. Public meetings and newsletters increase the opportunities for communication between industry and the community. Plans presented to a community must be realistic, well prepared, fair, and honest. A good working relationship between industry and the community benefits both in making the area a better place to live.

0310 Legislation and Regulations

4723 (CGPA–CE-02784, pp. 13) **Transportation issues in a deregulated environment.** Hassan, F.A. (Union Gas Ltd., Chatham, ON (Canada)). Canadian Gas Processors Association, Calgary, AB (Canada); Canadian Gas Processors Suppliers Association, Calgary, AB (Canada). 1988. (CONF-8811293–: Plant operating, maintenance and production conference, Calgary (Canada), 17 Nov 1988; CE–02784). In *Expanded markets: Meeting the challenge and avoiding the pitfalls.* Available from Info-Tech (Div. Of Maclean Hunter Ltd.), Suite 200, 1015 Centre Street North, Calgary, AB, CAN T2E 2P8. Prices: $35.00 CAN.

Union Gas is a fully integrated natural gas storage, transmission and distribution company in Ontario, serving residential, commercial and industrial customers. Union stores and transports gas for other energy companies and utilities as well as for its own distribution systems. The impact of the 1985 deregulation of the natural gas markets in Canada is discussed, notably as related to transport services. The impact on Union's system has been substantial; a number of gas purchase options have evolved, and a number of transportation service options are provided. The availability and access to transportation services on the upstream end is also discussed, such as the diminishing available capacity on the TransCanada PipeLines system and the reallocation of capacity on the Nova system. A number of outstanding issues are yet to be resolved before a truly market-responsive pricing regime and free access to transportation is achieved, including self-displacement and the removal of restrictions placed by governments on access to market priced gas supplies by certain classes of customers.

4724 (CGPA–CE-02784, pp. 13) **ERCB [Energy Resources Conservation Board] practices regarding gas plant applications.** Moeller, E.P. (Energy Resources Conservation Board, Calgary, AB (Canada)). Canadian Gas Processors Association, Calgary, AB (Canada); Canadian Gas Processors Suppliers Association, Calgary, AB (Canada). 1988. (CONF-8811293–: Plant operating, maintenance and production conference, Calgary (Canada), 17 Nov 1988; CE–02784). In *Expanded markets: Meeting the challenge and avoiding the pitfalls.* Available from Info-Tech (Div. Of Maclean Hunter Ltd.), Suite 200, 1015 Centre Street North, Calgary, AB, CAN T2E 2P8. Prices: $35.00 CAN.

A review is presented of the nontechnical components of an application to the Energy Resources Conservation Board of Alberta for the construction and operation of a gas processing plant in Alberta. The practices and procedures of the Board are discussed, as well as the administration of an application. The review provides basic information to the industry on such matters as the information requirements of an application, the apparent complexity and length of the regulatory process, the rights of the public, and what exactly happens to the application when the Board receives it. Specific examples are presented of the types of questions that Board staff are likely to ask about a gas plant application.

4725 (ERCB–D89-7) **Unocal Canada Mangement Limited application for approval of a sweet gas processing plant Albright and Beaverlodge fields.** Energy Resources Conservation Board, Calgary, AB (Canada). 1989. 19p. (CE–02781). Available from Energy Resources Conservation Board, 640-5th Ave. SW, Calgary, AB, CAN T2P 3G4. Prices: PRICES UPON REQUEST.

Unocal Canada Management Limited (Unocal) applied for approval to construct and operate a sour gas processing plant at an existing well site located in legal subdivision 6, section 17, township 72, range 9, west of the 6th meridian (6-17), in the Albright Field. The plant would be designed to process a maximum of 300.0×10^3 m^3/d of raw gas, from which 297.4×10^3 m^3/d of sales gas and 7.8 m^3/d of liquefied petroleum gases would be recovered. No sulphur or sulphur compounds would be emitted to the atmosphere. In its 20 March 1989 Notice of Hearing, the Energy Resources Conservation Board of Alberta indicated that it would consider the Unocal plant application in conjunction with applications by Dome Petroleum Limited (Dome) to gather and transport raw gas from the Albright and Beaverlodge fields to its existing Sinclair gas processing plant (Sinclair plant). The Unocal and Dome applications represented a scheme to divide production from 3 joint-interest wells and to produce them to both the Sinclair gas plant and the proposed Albright gas plant by way of a flow splitter. The issues considered by the board included the need for processing facilities, the processing alternatives, and the impacts and relative desirability of the proposal and of any processing alternatives. The Board concluded that processing Unocal's portion of the produced gas from the Albright and at the Dome-Sinclair gas plant may be a viable processing alternative, which and warrants further investigation by the applicant. Furthermore the Board was not convinced that the proposed 6-17 site was the most appropriate site. Therefore the application was denied without prejudice to any future application that Unocal may submit. 1 fig., 1 tab.

0320 Transport, Handling, and Storage

Refer also to citation(s) 4706, 5637

4726 (ACERR–CE-02764) **Thermographic detection system for pipeline leaks: Final report.** Alberta/Canada Energy Resources Research Fund, Edmonton, AB (Canada). 1985. vp. (CE–02764). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: $0.34 CAN per page, $3.40 minimum.

An extremely sensitive aerial gas leak detection system using infrared thermography has been developed to accomplish pipeline inspections from the air in a fraction of the time that it takes with the systems now in use. This project encompassed the modifications of the aircraft to accommodate the equipment, system calibration to determine the size of target that could be repeatedly detected, and the operational conditions under which the system could be used. The system was then field-tested in Canada to locate targets placed on a gas pipeline. The range of useful operating limits was determined in the course of field testing, such as: which weather conditions would give the best results, types of objects that would give a false signal, and equipment reliability in an aircraft. With proper system familiarity and data interpretation, the project showed that false indications can be easily detected. The system did locate, quite graphically and accurately, a number of placed targets and therefore proved itself to be a viable technology. It is estimated that, when the system is commercially developed, companies would get a realtime video plus the infrared detection for approximately $15.00 to $35.00 per mile, depending on the amount of line that is to be video-taped and which type of aircraft is to be used. 15 figs., 1 tab.

4727 (CGA/ES–CE-02773) **Directory of gas distribution transmission and production companies, 1988.** Canadian Gas Association, Don Mills, ON (Canada). Economics/Statistics Dept. Dec 1988. 109p. (CE–02773). Available from Canadian Gas Assn., 55 Scarsdale Rd., Don Mills, ON, CAN M3B 2R3. Prices: PRICES UPON REQUEST.

This directory provides information, by province, on Canadian Gas Association gas production members, divided into gas distribution, transmission, and production companies. Information was provided by the listed companies and is applicable to December 1988. Each listing includes details on corporate organization, area and population served, physical plant, employees, sales, exploration, and demand. Maps are included for each province, showing the distribution systems.

4728 (CGPA–CE-02784, pp. 9) **Transportation: Nova system.** Curtis, B. (Nova Corp. of Alberta, Calgary, AB (Canada)). Canadian Gas Processors Association, Calgary, AB (Canada); Canadian Gas Processors Suppliers Association, Calgary, AB (Canada). 1988. (CONF-8811293–: Plant operating, maintenance and production conference, Calgary (Canada), 17 Nov 1988; CE–02784). In *Expanded markets: Meeting the challenge and avoiding the pitfalls.* Available from Info-Tech (Div. Of Maclean Hunter Ltd.), Suite 200, 1015 Centre Street North, Calgary, AB, CAN T2E 2P8. Prices: $35.00 CAN.

An overview is given in outline form of the Alberta gas transmission division of Nova Corporation in relation to pipeline capacity and transportation. Information is given on contracts, system statistics, interruptible transportation, delivery capacity, and factors influencing the building of new facilities.

4729 (CGPA–CE-02784, pp. 25) **A large SCADA system: Two decades of evolution.** Barham, R. (Nova Corp. of Alberta, Edmonton, AB (Canada)); Wells, R. Canadian Gas Processors Association, Calgary, AB (Canada); Canadian Gas Processors Suppliers Association, Calgary, AB (Canada). 1988. (CONF-8811293–: Plant operating, maintenance and production conference, Calgary (Canada), 17 Nov 1988; CE–02784). In *Expanded markets: Meeting the challenge and avoiding the pitfalls.* Available from Info-Tech (Div. Of Maclean Hunter Ltd.), Suite 200, 1015 Centre Street North, Calgary, AB, CAN T2E 2P8. Prices: $35.00 CAN.

The Alberta Gas Transmission Division of NOVA Corporation operates a large natural gas transmission system in the province of Alberta. This paper describes the evolution of NOVA's gas pipeline control systems from manually operated compressor and meter stations to a centrally operated hierarchically controlled system. Emphasis is on the Supervisory Control and Data Acquisition (SCADA) system, with reference to closely integrated systems for on-line monitoring of the gas supply/demand situation and flow simulation. Current work towards a distributed SCADA system is described. The evolution is discussed in relation to the changing strategies and growth of the NOVA pipeline system. 2 refs., 5 figs.

4730 (CONF-890502–Summ.) **Symposium on current developments and trends in underground storage of natural gas and LPG [liquefied petroleum gas]: Summary.** United Nations, Geneva (Switzerland). Economic Commission for Europe. 29 Jun 1989. 15p. Sponsored by United Nations. From Seminar on current developments and trends on underground storage of natural gas and liquefied petroleum gas; Paris (France); 29 May - 3 jun 1989. Order Number DE90000086. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI.

The purpose of the Symposium was to exchange experience, views and information on the role of gas storage in gas market developments and its contribution in balancing gas supply and demand, the role of storage in enhancing security of gas supply and service for consumers, as well as regulatory, economic, technical and market factors influencing the selection and operation for various types of underground storage of natural gas and liquefied petroleum gas (LPG).

4731 (NRC/ACP–89-03549, pp. 17) **The development of a compressor station health monitoring system.** Hardeveld, T. Van (Nova, Edmonton, AB (Canada)). National Research Council of Canada, Ottawa, ON (Canada). Associate Committee on Propulsion. Sep 1987. (CONF-8709481–: 7. National Research Council of Canada (NRCC) symposium on industrial application of gas turbines, Banff (Canada), 27-30 Sep 1987; MICROLOG–89-03549). In *Proceedings [of the] seventh NRCC [National Research Council of Canada] symposium on industrial application of gas turbines.* Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Over the past few years, there has been a renewed interest in predictive maintenance techniques, including health or condition monitoring. Economic pressures have certainly contributed to the desire to operate equipment more efficiently and with lower maintenance cost but the main impetus to the development of better health monitoring techniques has been the availability of low-cost and powerful microcomputers and enhanced software development tools. These factors have led to the development of the Compressor Health Monitoring System, which has been prototyped, tested, enhanced, and implemented at 14 compressor station facilities in Alberta. More than 3 years of accumulated experience has been gained and a number of benefits have already been identified where problems have been noted and diagnosed successfully. Most importantly, operator acceptance has been very high since the system has served to enhance their role as the first line of defense. The objectives that should be considered when setting up a health monitoring system are presented, followed by a description of the major system functions. These include logging of such data as power output, fuel efficiency, gas flow, compressor head, compressor discharge pressure, and exhaust gas temperature; displaying data on graphs; providing records of operating data over a specified time period; taking into account changes in background information such as gas composition; monitoring the fluid levels of consumables; and system housekeeping such as data backups. The hardware and software development strategy is then outlined because of its importance in achieving the final objectives. Benefits of the system include timelines and accuracy of operating data, enabling operating costs to be reduced. 9 refs., 9 figs.

4732 (NRC/ACP–89-03549, pp. 10) **Conversion of gas compressors to improve efficiency.** Meier, R.H. (Cooper-Bessemer Rotating Products, Mount Vernon, OH (USA)). National Research Council of Canada, Ottawa, ON (Canada). Associate Committee on Propulsion. Sep 1987. (CONF-8709481–: 7. National Research Council of Canada (NRCC) symposium on industrial application of gas turbines, Banff (Canada), 27-30 Sep 1987; MICROLOG–89-03549). In *Proceedings [of the] seventh NRCC [National Research Council of Canada] symposium on industrial application of gas turbines.* Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The application of a proven design concept to achieve superior aerodynamic efficiency in new centrifugal pipeline boosters to existing units is presented. Experience of a Canadian pipeline company when it modified its compressor designs to handle increased gas flows, indicated that the large resultant increase in flow exceeded good design practice for flow velocity in piping and in the compressor itself. This translates into significant losses (pressure drops), which directly affect fuel consumption. This recognition, and the positive experience with highly efficient axial inlet boosters, led to examination of the feasibility of converting existing boosters with a conventional side inlet to an axial inlet. At the same time, unit piping size was increased to reduce piping losses. To minimize total conversion costs, the existing compressor was not replaced with a true axial inlet booster, but modifications were made to the compressor and its suction piping. The main new compressor component was a new casing cover that accommodates the new axial intake flange. Performance tests indicated excellent results, with power savings of 3-8% realized on units converted to date. The magnitude of savings depends on relative volume flow and pressure ratio requirements. Further performance gains could be realized from the installation of a true axial inlet pipeline booster. 2 refs., 7 figs.

4733 (NRC/ACP–89-03549, pp. 23) **Operation of oil-less seal and bearing systems for centrifugal compressors.** Lancee, R.P. (TransCanada PipeLines Ltd., Toronto, ON (Canada)). National Research Council of Canada, Ottawa, ON (Canada). Associate Committee on Propulsion. Sep 1987. (CONF-8709481–: 7. National Research Council of Canada (NRCC) symposium on industrial application of gas turbines, Banff (Canada), 27-30 Sep 1987; MICROLOG–89-03549). In *Proceedings [of the] seventh NRCC [National Research Council of Canada] symposium on industrial application of gas turbines.* Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Booster compressors or a natural gas pipeline system have long been plagued by the problems associated with oil entrainment in the natural gas stream and the inherent maintenance problems associated with oil systems. The use of dry gas seals and active magnetic bearings will effectively eliminate the further use of oil systems in gas compression. This paper describes TransCanada PipeLines' past experiences with oil-free seals, the theory of dry gas seals and active magnetic bearings, the effects on rotor dynamics by magnetic bearings, and the recent installation and operation of a set of dry gas seals and active magnetic bearings in a booster compressor unit operating on the TransCanada PipeLines system. It is seen that satisfactory operation was obtained, with simplified startup and operation due to a minimum number of valves, controllers, vessels, and electrical equipment. Improved performance relative to conventional oil bearings was achieved through reduced parasitic losses within the seal itself and that associated with auxiliary equipment. The partial elimination of the oil system has led to significantly reduced maintenance costs and elimination of oil contamination. 4 refs., 8 figs., 1 tab.

4734 (ORF–TE-87-12, pp. 87-118) **Effects of natural gas contaminants on corrosion in compressed natural gas (CNG) storage cylinders.** Ontario Research Foundation, Sheridan Park, ON (Canada). Sep 1987. (CONF-870690–: 3. Windsor workshop on alternative fuels, Windsor (Canada), 24-26 Jun 1987; CE–02782). In *Proceedings of the third Windsor workshop on alternative fuels.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: N/C.

The primary objective of this research is to define natural gas contaminant concentration limits necessary to ensure that the interval corrosion of compressed natural gas (CNG) cylinders does not constitute a hazard over the lifetimes of the cylinders. Secondary objectives are to determine the effects of CNG system parameters on corrosion, and to determine whether exposure of CNG cylinder materials to untreated natural gases from New York State wells causes stress corrosion cracking. The principal corrosive contaminants present in US natural gases are carbon dioxide, hydrogen sulfide, other soluble sulfides, and water. It appears that the aluminium alloy 6061-T6 was not susceptible to stress corrosion cracking in any environment tested, including hydrogen sulfide environments which induced severe cracking in 4130x and 15B30 steels. Normalized 4130x steel eylinders should not be used in CNG service. However, 4130x and 15B30 steels quenched- and tempered to a hardness level of HRC 26 or less may be used in CNB service with natural gas supplies which meet the gas-quality standard. This standard is included at the end of the paper. Additional research requirements are listed. 5 figs., 6 tabs.

0340 Combustion

Refer also to citation(s) 5360, 5394

4735 (PB–89-231591/XAB) **Development of an advanced gas-fired mineral-wool melter. Annual report, January-December 1988.** Vereecke, F.J.; Thekdi, A.C. Leadbetter (A.C.) and Son, Inc., Toledo, OH (USA). Jun 1989. 38p. Available from NTIS, PC A03/MF A01.

A gas-fired mineral-wool melter was designed to provide a melting technology option to the existing coke-fired cupola melters used by the mineral wool industry. Over the past few years, mineral-wool producers have been increasingly pressured to reduce their level of pollutant gaseous emissions. Including the fuel consumption for an afterburner required with a cupola melter, the direct production costs for fuel currently range from $32 to $44 per ton of melted product; dependent on the effectiveness of a heat-recovery system. The estimated direct fuel cost for a gas-fired mineral-wool melter could be as low as $16 per ton. The configuration of the prototype melter contributes to the energy savings because waste heat is reclaimed by preheating the feedstock in a counterflow shaft. Besides the beneficial decrease in energy costs, the proposed gas-fired melter will virtually eliminate carbon monoxide and unburned hydrocarbon emissions as well as substantially reduce emissions of hydrogen sulfide. Finally, with an improved capability to process the melted product at a controlled temperature and flow rate, the gas-fired melter should improve the overall quality of the mineral fiber product compared to the state-of-the-art coke-fired cupola melter.

04 OIL SHALES AND TAR SANDS

4736 (CHOA–CE-02645) **Environment & surface facilities challenges. Proceedings [of the] quarterly meeting of the Canadian Heavy Oil Association.** Canadian Heavy Oil Association (Canada). 1988. VP (CONF-881099–: 15. Canadian rock mechanics symposium, Toronto (Canada), 3-4 Oct 1988; CE–02645). Order Number DE90705984. Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, CAN T5J 3L8. Prices: N/C.

Individual papers are processed separately for the data base. (DLC)

0402 Reserves, Geology, and Exploration

Refer also to citation(s) 4713

0404 Oil Production, Recovery, and Refining

Refer also to citation(s) 4688, 4689, 5111

4737 (CHOA–02645) **Environment & surface facilities challenges. Proceedings [of the] quarterly meeting of the Canadian Heavy Oil Association.** Canadian Heavy Oil Association (Canada). 1988. vp. (CONF-8810454–: Quarterly meeting of the Canadian Heavy Oil Association, Calgary (Canada), 25 Oct 1988; CE–02645). Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, CAN T5J 3L8. Prices: N/C.

This meeting on environment and surface facilities in oil sands and heavy oil operations included presentations on treatment of produced waters, steam generation for enhanced recovery, and waste management. Separate abstracts have been prepared for seven papers from this meeting.

4738 (CHOA–CE-02645, pp. 8) **TransAlta's low NO_x/SO_x burner and its application to enhanced oil recovery steam raising.** Nish, J.I. (TransAlta Utilities Corp. AB (Canada)). Canadian Heavy Oil Association (Canada). 1988. (CONF-8810454–: Quarterly meeting of the Canadian Heavy Oil Association, Calgary (Canada), 25 Oct 1988; CE–02645). In *Environment & surface facilities challenges. Proceedings [of the] quarterly meeting of the Canadian Heavy Oil Association.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, CAN T5J 3L8. Prices: N/C.

The use of Alberta's vast reserves of subbituminous coal as a fuel for steam generation at enhanced oil recovery projects has been proposed, but a significant use of such a fuel would require an effective emissions control method. One such method is provided by use of a new low NOx/SOx (LNS) burner developed by TransAlta Utilities. The burner concept is that of an entrained-flow combustion system, consisting of a refractory lined cylinder located externally on the steam generator. The burner can be used in both new installations and retrofitting of installations burning oil or gas. The initial coal combustion takes place in the refractory lined cylinder, and the combustion products that enter the steam generator consist of a very hot, low-BTU fuel gas. Additional air is added to the gas to complete the coal combustion in the same area of the steam generator as the gas or oil was burned. The burner is currently being used in demonstration projects to lead to commercialization. 1 fig.

4739 (CHOA–CE-02645, pp. 14) **Activated alumina adsorption of silica and dissolved organics from produced water.** Zaidi, S.A. (Environment Canada, Burlington, ON (Canada)); McFayden, D.W. Canadian Heavy Oil Association (Canada). 1988. (CONF-8810454–: Quarterly meeting of the Canadian Heavy Oil Association, Calgary (Canada), 25 Oct 1988; CE–02645). In *Environment & surface facilities challenges. Proceedings [of the] quarterly meeting of the Canadian Heavy Oil Association.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, CAN T5J 3L8. Prices: N/C.

Technologies available for removal of silica from water produced during in-situ recovery of heavy oil by steam injection are of interest to those considering the use of such produced water for steam generation. Experiments were conducted to investigate the use of activated alumina for adsorption of silica and selected organics. The organics used during the study were those that commonly occur in produced waters in relatively high concentrations. The purpose of the study was to determine if the presence of the organics would have a significant negative impact on the ability of the activated alumina to adsorb silica. Preliminary tests on the adsorption kinetics of silica on activated alumina indicate that 70% of the adsorption occurs during the first half hour of contact. It appears that use of a smaller particle size of alumina and highly turbulent mixing could enhance the adsorption kinetics. Some of the silica adsorbed irreversibly and could not be eluted by a caustic wash. One group of hydrophilic organics, benzoic acids, adsorbed on activated alumina, but its presence did not affect the adsorption capacity for silica. Phenolics and indanol commonly present in produced waters also do not interfere with silica adsorption. 22 refs., 2 figs., 4 tabs.

4740 (CHOA–CE-02645, pp. 9) **Status of silica levels in steam generator feedwaters.** Merritt, D. (Merritt Process & Research, Ltd. (Canada)). Canadian Heavy Oil Association (Canada). 1988. (CONF-8810454–: Quarterly meeting of the Canadian Heavy Oil Association, Calgary (Canada), 25 Oct 1988; CE–02645). In *Environment & surface facilities challenges. Proceedings [of the] quarterly meeting of the Canadian Heavy Oil Association.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, CAN T5J 3L8. Prices: N/C.

Previous guidelines for permissible silica content in steam generator feedwater have indicated an upper limit of 50-60 ppM. Many heavy oil surface facilities have been designed and operated based on this limit. Current engineering design and operating practices are changing, as seen from this report. The status of current criteria and operating practice in California and Alberta is reviewed, indicating the possibility in some cases of raising the silica level up to 150 or 200 ppM. Feedwater chemistry is very complex and silica level must be considered together with the iron content, the hardness leakage and the pH. Evaluation of the coordinated chemistry must also include consideration of possible effects on the injection formation.

4741 (CHOA–CE-02645, pp. 37) **Hydrocyclone separator used in steam flood applications.** Bowers, B. (B.W.N. Vortoil). Canadian Heavy Oil Association (Canada). 1988. (CONF-8810454–: Quarterly meeting of the Canadian Heavy Oil Association, Calgary (Canada), 25 Oct 1988; CE–02645). In *Environment & surface facilities challenges. Proceedings [of the] quarterly meeting of the Canadian Heavy Oil Association.* Available from Alberta Oil Sands

Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, CAN T5J 3L8. Prices: N/C.

Field trials have demonstrated the practicality of using the Vortoil separator, consisting of a process vessel containing one or more liquid-liquid separation hydrocyclones, for removal of heavy oil from produced water in steamflooding applications. The design of the Vortoil comprises a 4-section liner which effects the functional geometry of the hydrocyclone, and a containment pipe or vessel which supports the liner and allows connection to the process and operation under high pressure. The oil-water mixture is introduced to the hydrocyclone through a specially designed inlet into a cylindrical swirl chamber. The rotation is accelerated through the concentric reducing section and sufficient spin rate to achieve centrifugal separation is achieved. Separation mainly occurs in the tapered sections, with smaller droplets tending to be recovered in the parallel tail section. The oil-enriched core is removed through a small-diameter orifice located in the center of the inlet chamber. Factors influencing performance are discussed, including specific gravity, temperature, flow rate, percent solids, and type and quantity of treatment chemicals used. A significant consideration for Vortoil application is the requirement for a driving force in the form of pressure; pressure drop and flow rate characteristics are outlined. Four basic possibilities for Vortoil control are addressed. Performance can be enhanced by use of an upstream coalescer and/or a downstream enhancement vessel. Field trials in California and at Cold Lake, Alberta are described. 3 refs., 20 figs., 5 tabs.

4742 (UCRL–102123) **LLNL hot-recycled-solid retorting: Small-scale tests and large-scale plans.** Cena, R.J.; Mallon, R.G. Lawrence Livermore National Lab., CA (USA). Oct 1989. 7p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-7405-ENG-48. (CONF-891253–1: 5. Australian workshop on oil shale, Sydney (Australia), 7-8 Dec 1989). Order Number DE90002237. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Lawrence Livermore National Laboratory (LLNL) has conducted research on oil shale for more than 15 years with recent emphasis on surface retorting employing hot-recycled-solid as the heat carrying media. Results of laboratory and 1-tonne-per-day pilot-scale experiments have been reported elsewhere. We are beginning operation of a 4-tonne-per-day continuous-loop system designed to use commercially sized shale (7-mm) and test key process components suitable for scale-up demonstration and commercial sizes. We describe our 4-tonne-per-day hot-recycled-solid retort and future plans to construct and operate 100 and 1,000 tonne-per-day pilot-scale tests at a mine site in western Colorado. 2 figs., 2 tabs.

4743 (WU/WCP–89-02165-1) **[Inhibition of coke formation in bitumen-coal coprocessing as measured by the plastrofrost apparatus]: Final report.** Silverston, P.L.; Royce, A. Waterloo Univ., ON (Canada). Waterloo Centre for Process Development. Jan 1988. 95p. Contract CES 69139-01-5Q. (MICROLOG–89-02165). Available from PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The objective of this study was to investigate the inhibition of coke fusion and/or formation by the ferrous sulphate additive employed in the CANMET process of bitumen-coal coprocessing. A Plastofrost apparatus was used for the above purpose, along with a specially developed procedure to handle the slurry. Three Canadian coals - Forestburg (subbituminous-C), Prince Mine (high volatile bituminous(hvb)-B), and Lingan Mine (hvb-A) were used along with an Illinois #6 (hvb-C) coal. The slurry fluid was a Cold Lake vacuum bottoms. Plastofrost samples were prepared of the coals with 0, 5 and 20 wt% additive, the vacuum bottoms, and slurries of 30 wt% coal in the vacuum bottoms with additive levels of 0,5 amd 20 wt %. Prince Mine and Illinois #6 coals did not become fluid suggesting ageing of the samples had occurred. With the Lingan Mine coal, additive delayed initial fusion of the coal grains and completion of fusion. At 20 wt% additive complete fusion did not occur. The anisotropic texture of the semicoke was diminished by the additive. The presence of vacuum bottoms suppresses coal fusion, probably by physically separating the coal grains. Fusion is also slightly supressed at 20 wt% additive; 5 wt% seemed to have little effect. dissolution of vitrain in the bitumen was not observed. The coal and vacuum bottom phases carbonize separately yielding distinct, but well bonded semicokes. Anisotropic texture of the vacuum bottoms coke is strongly diminished by the presence of the finely ground coal. 6 refs., 23 figs., 8 tabs.

4744 **Size, mineral, and organics distribution in crushed oil shales.** Grimm, U. (US DOE, Morgantown, WV (US)); Shadle, L. pp. 469 of Chemical separations. King, C.J.; Navratil, J.D. Litarvin Literature, Arvada, CO (1986). (CONF-860411–: 1. international conference on separations science and technology, New York, NY (USA), 15-17 Apr 1986).

The Morgantown Energy Technology Center (METC) is investigating the high heating rate pyrolysis of oil shale in an entrained reactor system. As part of this study, an investigation was carried out to find the minimum size range of crushed oil shale particles which still can be considered to be representative of the basic-kerogen containing material. The size should be small and the size range narrow to more easily allow modeling of the entrainment and the pyrolysis effect for this reactor system. A western and an eastern oil shale were processed in a hammer mill in a once-through mode, and the resulting powder was screen analyzed. The different size ranges were rigorously analyzed for their integrity, and it was found that the grain sizes of the mineral matter inter and intra the bedding layers are alike and around 5 μm. The fact that the intra bedding layer particles are bound to a lesser degree by the kerogen causes the mineral material to be increased in the smaller size fractions. It has been determined that a size range of 74 to 88 μm is favorable for comparative studies of both oil shales. Recommendations are made for the classification of shales from other sources.

0405 Properties and Composition

Refer also to citation(s) 4710, 4744

4745 (DOE/MC/11076–2743) **A correlation of United States tar sand bitumen viscosities with NMR spectroscopic parameters: Progress report.** Netzel, D.A.; Turner, T.F. Western Research Inst., Laramie, WY (USA). Jun 1989. 22p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FC21-86MC11076. Order Number DE90000400. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A method has been developed whereby the viscosity of a tar sand bitumen at any temperature can be calculated from nuclear magnetic resonance parameters. The method is semiempirical but is based upon some fundamental theoretical concepts for molecular mobility and intermolecular interactions. Using this method, the viscosities of three United States tar sand bitumens have been correlated to the weighted average spin-spin relaxation rates for the semiliquid, solidlike mobile, and solidlike rigid phases of the bitumens. The results indicate that bitumens with a high viscosity have a greater amount of solidlike rigid phase and lesser amounts of solidlike mobile and semiliquid phases than do the bitumens with low viscosity. It is also shown that the viscosity of a tar sand bitumen over a 100 degree temperature range can be determined from a single NMR experiment conducted near room temperature. 18 refs., 3 figs., 4 tabs.

4746 (GS–89-1G, pp. 51-55) **Optical and compositional characters and paleothermal implications of a diverse suite of natural bitumens from Middle Devonian carbonate rocks, Pine Point, Northwest Territories.** Kirste, D. (Univ. of Waterloo, Waterloo, ON (Canada)); Fowler, M.G.; Goodarzi, F.; Macqueen, R.W. Geological Survey of Canada, Ottawa, ON (Canada). 1989. (MICROLOG–89-03293). In *Current research, part G. Frontier geoscience program, Arctic Canada.* Available from PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

The Pine Point lead-zinc property offers a unique opportunity to study the variations and origins of a diverse suite of natural bitumens derived from a single source facies and occurring in a geographically and geologically limited area features unknown elsewhere. Reflectance, fluorescece, and solubility studies indicate that

the Pine Point property hosts natural bitumen species ranging from asphalt to gilsonite, glance pitch, grahamite and epi-impsonite, as well as an unclassified species. Biomarker distributors from bitumen extracts display non-biodegraded to severely biodegraded fingerprints and low to moderate maturity, and confirm the F facies as the source facies, as earlier concluded by conventional organic geochemistry and stratigraphic studies. The Pine Point bitumen suite verifies that the optical character of natural bitumen combined with chemical composition may be a very sensitive index of thermal and chemical environments that were present in the evolution and alteration of these natural bitumens. 22 refs., 2 tabs.

0407 Health and Safety

Refer also to citation(s) 4657

0409 Waste Management

Refer also to citation(s) 4601, 4688, 4737, 4739

4747 (CHOA–CE-02645, pp. 29) **Treatment of heavy oil wastes, emulsions, sludges and spills with an AOSTRA [Alberta Oil Sands Technology and Research Authority] Taciuk processor.** Ritcey, R.M. (UMATAC Industrial Processes, Calgary, AB, (Canada)). Canadian Heavy Oil Association (Canada). 1988. (CONF-8810454–: Quarterly meeting of the Canadian Heavy Oil Association, Calgary (Canada), 25 Oct 1988; CE–02645). In *Environment & surface facilities challenges. Proceedings [of the] quarterly meeting of the Canadian Heavy Oil Association.* Available from Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, CAN T5J 3L8. Prices: N/C.

The Taciuk processor consists of a single horizontal, rotating vessel which contains individual compartments in which the processing steps separate and recover various constituents of input feed materials. The processor is the heart of a treatment plant in which hydrocarbons and water are separated and recovered from oil-bearing feeds. The potential for using the Taciuk processor for treating the oily wastes from oilfield crude oil production was examined in an extensive test program. Seventeen different waste types, primarily from heavy oil and bitumen production, were tested, using both batch-type tests and full-scale process test runs with the 120 ton per day processor located in Calgary, Alberta. The program had the objective to determine: the ability of the processor to handle and treat wastes on a production basis; the environmental acceptability of the process products for final disposal or reuse, particularly the solids; and a preliminarly design and costs of a treatment plant located in the oilfield production area. The program demonstrated that the processor can remove all the oil from the wastes, produce solids which are suitable for landfill disposal, and recover as much as 80 wt % of the oil contained in the waste feed. A movable treatment plant could provide full-service waste treatment at an operating cost of $55 to $75 per ton, or $70 to $95 per ton in 1988 Canadian dollars including recovery of plant capital costs. 5 figs., 10 tabs.

05 NUCLEAR FUELS

Refer also to citation(s) 5806, 6453, 6454, 6456

0501 Reserves, Exploration, and Mining

4748 (LA-UR–89-3911) **Exploration geochemistry: The Los Alamos experience.** Maassen, L.W.; Bolivar, S.L. Los Alamos National Lab., NM (USA). [1989]. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891256–1: IAEA Consultants meeting, Espoo (Finland), 11-13 Dec 1989). Order Number DE90003660. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Los Alamos National Laboratory became actively involved in geochemical exploration in 1975 by conducting a reconnaissance-scale exploration program for uranium as part of the National Uranium Resource Evaluation program. Initially, only uranium and thorium were analyzed. By 1979 Los Alamos was analyzing a multielement suite. The data were presented in histograms and as black and white concentration plots for uranium and thorium only. Data for the remaining elements were presented as hard copy data listings in an appendix to the report. In 1983 Los Alamos began using exploration geochemistry for the purpose of finding economic mineral deposits to help stimulate the economies of underdeveloped countries. Stream-sediment samples were collected on the Caribbean island of St. Lucia and a geochemical atlas of that island was produced. The data were statistically smoothed and presented as computer-generated color plots of each element of the multielement suite. Studies for the US Bureau of Land Management in 1984 consisted of development of techniques for the integration of several large data sets, which could then be used for computer-assisted mineral resource assessments. A supervised classification technique was developed which compares the attributes of grid cells containing mines or mineral occurrences with attributes of unclassified cells not known to contain mines or occurrences. Color maps indicate how closely unclassified cells match in attributes the cells with mines or occurrences. 20 refs., 1 fig., 1 tab.

4749 (NUCLEBRAS-EBEL-PM-NT–001/83) **Possibilities of uranium recovering as by product of copper lixiviation solution in Salobo 3-Alfa-Carajas.** Hohn, H.; Ferraioli, R.N.M. NUCLEBRAS, Belem, PA (Brazil). Superintendencia Geral de Prospeccao e Pesquisa Mineral. May 1983. 80p. (In Portuguese). Order Number DE90608132. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Geochemical and geophysics regional surveys performed by Nuclebras in 'Carajas, Para' State, show several favourable areas for uranium prospecting, including the 'Salobo 3-Alfa' copper mine. Some studies for increasing the Knowledge of uranium quantity and proportion and for accompanying the pilot plant installation, aiming the uranium extraction during the cycel of ore treatment in 'Salobo 3-Alfa' mine are described.

4750 (NUCLEBRAS-EBEL-PM-NT–002/87) **Geochemical behaviour of U_3O_8, Mo, Y, Ga, V and Zr in laterite - bauxitic sequence of the "Croanta-Paragominas".** Ferraioli, R.N.M.; Ferreira, Z.C.A. NUCLEBRAS, Belem, PA (Brazil). Superintendencia Geral de Prospeccao e Pesquisa Mineral. Oct 1987. 27p. (In Portuguese). Order Number DE90607894. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Fifteen samples are studied, analyzed for U_3O_8 (delayed neutrons), ThO_2 (X-ray fluorescence spectrometry) and Mo, Y, Ga, V and Zr (optical emission spectrography) in laterite - bauxitic sequence of the Paragominas, Brazil. Generical datas about the arrangements of thorium, uranium and zirconium are also presented. (C.G.C.).

0504 Feed Processing

Refer also to citation(s) 5548

4751 **Recovery of uranium from 30 vol % tributyl phosphate solvents containing dibutyl phosphate.** Mailen, J.C. (Oak Ridge National Lab., Oak Ridge, TN (US)); Tallent, O.K. pp. 469 of Chemical separations. King, C.J.; Navratil, J.D. Litarvin Literature, Arvada, CO (1986). (CONF-860411–: 1. international conference on separations science and technology, New York, NY (USA), 15-17 Apr 1986).

A number of solid sorbents were tested for the removal of uranium and dibutyl phosphate (DBP) from 30% tributyl phosphate (TBP) solvent. The desired clean uranium product can be obtained either by removing the DBP, leaving the uranium in the solvent for subsequent stripping, or by removing the uranium, leaving the DBP in the solvent for subsequent treatment. Solid sorbents were tested in shake-outs, and promising candidates were examined in small packed columns. The variables examined included temperature and residence time of the solvent in contact with the solid sorbent. No method for removing DBP while leaving the uranium in the solvent was found. Both cation resins and diethylkenetraimine pentaacetic acid (DTPA) deposited on glass beads preferentially removed the uranium, leaving the DBP in the solvent. The DBP could then be readily removed by a number of simple treatments, and the uranium

could be recovered by elution with acidified TBP. Both hydroxide-form anion exchange resins and activated alumina (used with dry solvent) removed both uranium and DBP. It is possible that the DBP and uranium could be separately eluted from these sorbents, but it was not successfully tested. These results suggest a number of possible applications in solvent extraction systems.

0505 Uranium Enrichment

Refer also to citation(s) 6045

4752 (K/ETO–4) **Isotopic selectivity of surface diffusion: An activated diffusion model.** Trowbridge, L.D. Oak Ridge Gaseous Diffusion Plant, TN (USA). Nov 1989. 43p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OT21400. Order Number DE90003473. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Gaseous diffusion systems are designed to separate UF_6 isotopes by pumping gas through a microporous membrane. A second mode of transport exists in barrier, namely that of surface diffusion. The primary purpose of this report is to illustrate, with a very simple model, the qualitative behavior of surface diffusion in a way intended to retain the physical insight into how this flow will behave, and to show how it might manifest itself when observed in combination with gas-phase flow. The model developed uses general concepts of activated diffusion and the Langmuir adsorption isotherm to examine surface diffusion from the standpoint of characteristics important to isotope separation, namely the conductivity and isotopic selectivity of surface flow, as a function of temperature, pressure, and adsorption energy. 25 refs., 14 figs., 5 tabs.

0507 Fuels Production and Properties

Refer also to citation(s) 4886, 5107, 5166, 5369, 5416, 5487, 5488, 5856

4753 (CONF-891206–1) **Properties and thermal decomposition of the double salts of uranyl nitrate-ammonium nitrate.** Notz, K.J.; Haas, P.A. Oak Ridge National Lab., TN (USA). [1989]. 17p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. From International chemical congress of Pacific Basin Society symposium on polymer rheology and processing (PACIFICHEM '89); Honolulu, HI (USA); 17-22 Dec 1989. Order Number DE89004909. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The formation of ammonium nitrate-uranyl nitrate double salts has important effects on the thermal denitration process for the preparation of UO_3 and on the physical properties of the resulting product. Analyses were performed, and properties and decomposition behavior were determined for three double salts: $NH_4UO_2(NO_3)_3$, $(NH_4)_2UO_2(NO_3)_4$, and $(NH_4)_2UO_2(NO_3)_4 \cdot 2H_2O$. The trinitrate salt decomposes without melting at 270–300°C to give a γ-UO_3 powder of $\sim$ 3-μm average size, with good ceramic properties for fabrication into UO_2nuclear fuel pellets. The tetranitrate dihydrate melts at 48°C; it also dehydrates to the anhydrous salt. The anhydrous tetranitrate decomposes exothermically, without melting, at 170–270°C by losing one mole of ammonium nitrate to form the trinitrate salt. 17 refs., 3 figs., 3 tabs.

4754 (IWGFPT–32, pp. 307-313) **Thermal conductivity of UO_2.** Winter, P.W. (UKAEA Safety and Reliability Directorate, Culcheth (UK)); MacInnes, D.A. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

The thermal conductivity of UO_2 is analysed as a function of porosity, stoichiometric deviation, burnup and temperature. The dependence of the phonon and electronic contributions on these parameters is discussed in detail. (author). 41 refs, 1 fig., 4 tabs.

4755 (LA-UR–89-3837) **REBOCOL [Robotic Calorimetry]: An automated NDA [Nondestructive assay] calorimetry and gamma isotopic system.** Hurd, J.R.; Bonner, C.A.; Ostenak, C.A.; Phelan, P.F.; Powell, W.D.; Sheer, N.L.; Schneider, D.N.; Staley, H.C. Los Alamos National Lab., NM (USA). [1989]. 36p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-891103–48: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE90003217. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

ROBOCAL, which is presently being developed and tested at Los Alamos National Laboratory, is a full-scale, prototypical robotic system, for remote calorimetric and gamma-ray analysis of special nuclear materials. It integrates a fully automated, multi-drawer, vertical stacker-retriever system for staging unmeasured nuclear materials, and a fully automated gantry robot for computer-based selection and transfer of nuclear materials to calorimetric and gamma-ray measurement stations. Since ROBOCAL is designed for minimal operator intervention, a completely programmed user interface and data-base system are provided to interact with the automated mechanical and assay systems. The assay system is designed to completely integrate calorimetric and gamma-ray data acquisition and to perform state-of-the-art analyses on both homogeneous and heterogeneous distributions of nuclear materials in a wide variety of matrices. 10 refs., 10 figs., 4 tabs.

4756 (WHC-SA–0777) **Westinghouse Hanford Job Control System: Integration of preventive maintenance systems into a job control system.** Hayenga, J.L.; Longwell, T.C. Westinghouse Hanford Co., Richland, WA (USA). Oct 1989. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-87RL10930. (CONF-8910260–4: Plutonium/uranium recovery operations conference, Oak Ridge, TN (USA), 24-26 Oct 1989). Order Number DE90003360. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The goal of a maintenance program is to assure equipment is available to function as required. To meet this goal corrective maintenance (CM) and preventive maintenance (PM) programs are essential, and both should be considered when evaluating a maintenance program. Work control is the tool used to effectively control CM and PM. We will consider reasons that Corrective and Preventive Maintenance programs should be integrated. How the 200 Area Preventive Maintenance program is being integrated into the Job Control System (JCS), and problems posed by an operation like Hanford which is large scale in terms of geography, number of components and number of independently run plants.

0508 Spent Fuels Reprocessing

Refer also to citation(s) 4751, 4760, 4763, 4766, 4875, 5107, 5606, 5612

4757 (BMU–1989-227) **Comparison of FIPLOC-M with FIRAC computations on aerosol release in the event 'earthquake with subsequent solvent fire'.** Schriftenreihe Reaktorsicherheit und Strahlenschutz. Ergebnisberichte, Untersuchungen, Studien, Gutachten. Weber, G.; Huber, J. Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.); Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.). Jan 1989. 64p. (In German). Contract BMU SR 823/1. Available from Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.).

The event 'earthquake with subsequent solvent fire' in the low level active waste management area of the Wackersdorf reprocessing plant has been modelled by two different computer codes FIPLOC-M (GRS) and FIRAC (Los Alamos). The results have been compared and are described. The fire itself with its gas and aerosol generation rates has been simulated by the FIRIN code which is integrated in FIRAC. The results were fed identically into FIPLOC and FIRAC. FIRAC underestimated the quantity of aerosols released to the environment by about 20%. The reasons for this result have been determined and analysed. Other differences between the results and models are described too. For the simulation of transportation pathways which comprise one or more larger volumes and

which are therefore not typical for the application of FIRAC the FIPLOC code gives better results concerning aerosol transport and deposition effects. Also aerosol modelling is more precise in FIPLOC (MAEROS module) than in FIRAC. On the other hand ventilation components such as filters or blowers are simulated much better in the FIRAC code. (orig./HP).

4758 (DOE/EH–0097) **Technical safety appraisal of the West Valley Demonstration Project.** USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA). Sep 1989. 240p. Sponsored by U.S. DOE Environment Health & Safety. Order Number DE90003490. Available from NTIS, PC A11/MF A01; OSTI; INIS; GPO Dep.

This report presents the results of one in a series of Technical Safety Appraisals (TSAs) being conducted of DOE nuclear operations by the Assistant Secretary for Environment, Safety, and Health Office of Safety Appraisals TSAs are one of the ititiatives announced by the Secretary of Energy on September 18, 1985, to enhance the DOE environment, safety and health program. This report presents the results of a TSA of the West Valley Demonstration Project (WVDP). The appraisal was conducted by a team of exerts assembled by the DOE Office of Safety Appraisal and was conducted during onsite visits of June 26-30 and July 10-21, 1989. West Valley, about 30 miles south of Buffalo, New York is the location of the only commercial nuclear fuel reprocessing facility operated in the United States. Nuclear Fuels Services, Inc. (NFS) operated the plant from 1966 to 1972 and processed about 640 metric tons of spent reactor fuel. The reprocessing operation generated about 560,000 gallons of high-level radioactive waste, which was transferred into underground tanks for storage. In 1972 NFS closed the plant and subsequently decided not to reopen it.

0509 Transport, Handling, and Storage

Refer also to citation(s) 4782, 5022, 5622, 5630, 5636

4759 (IAEA-TECDOC–513) **Management of spent fuel from research and prototype power reactors and residues from post-irradiation examination of fuel. Proceedings of a technical committee meeting held in Vienna, 28 November - 1 December 1988.** International Atomic Energy Agency, Vienna (Austria). Sep 1989. 146p. (CONF-8811290–: Technical committee on the safe management of spent fuel from research reactors, prototype power reactors and fuel from commercial power reactors that has been subjected to post-irradiation examinatio, Vienna (Austria), 28 Nov - 1 dec 198 Order Number DE90610069. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

The safe and economic management of spent fuel is important for all countries which have nuclear research or power reactors. It involves all aspects of the handling, transportation, storage, conditioning and reprocessing or final disposal of the spent fuel. In the case of spent fuel management from power reactors the shortage of available reprocessing capacity and the rising economic interest in the direct disposal of spent fuel have led to an increasing interest in the long term storage and management of spent fuel. The IAEA has played a major role in coordinating the national activities of the Member States in this area. It was against this background that the Technical Committee Meeting on "Safe Management of Spent Fuel From Research Reactors, Prototype Power Reactors and Fuel From Commercial Power Reactors That Has Been Subjected to PIE (Post Irradiated Examination)" (28th November - 1st December 1988) was organised. The aims of the current meeting have been to: 1. Review the state-of-the-art in the field of management of spent fuel from research and prototype power reactors, as well as the residues from post irradiation examination of commercial power reactor fuel. The emphasis was to be on the safe handling, conditioning, transportation, storage and/or disposal of the spent fuel during operation and final decommissioning of the reactors. Information was sought on design details, including shielding, criticality and radionuclide release prevention, heat removal, automation and remote control, planning and staff training; licensing and operational practices during each of the phases of spent fuel management. 2. Identify areas where additional research and development are needed. 3. Recommend areas for future international cooperation in this field. Refs, figs and tabs.

4760 (IAEA-TECDOC–513, pp. 9-14) **Management of spent fuel from prototype and experimental reactors.** Ballagny, A. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). International Atomic Energy Agency, Vienna (Austria). Sep 1989. (CONF-8811290–: Technical committee on the safe management of spent fuel from research reactors, prototype power reactors and fuel from commercial power reactors that has been subjected to post-irradiation examinatio, Vienna (Austria), 28 Nov - 1 dec 198 In *Management of spent fuel from research and prototype power reactors and residues from post-irradiation examination of fuel. Proceedings of a technical committee meeting held in Vienna, 28 November - 1 December 1988.* Order Number DE90610069. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

The French Atomic Energy Commission (Commissariat a l'Energie Atomique, C.E.A.) has operated research and prototype reactors for many years. It is thus faced with the problem of the management of irradiated exotic fuels that are very different from power reactor fuels which are commercially reprocessed. For each type of reactor there is a procedure for the removal of spent fuel which is designed to minimise the storage time, on the reactor site. This procedure provides for the immediate reprocessing of the fuel when reprocessing is in operation, otherwise the fuels are securely stored in facilities from which they may be easily recovered when a definitive solution is found. UA1 Fuel: This fuel which is 93% enriched is used in the reactors SILOE, MELUSINE and ORPHEE is reprocessed in the USA. High enriched fuel is going to be replaced by U_3Si_2 20% enriched except for ORPHEE. UO_2 Fuel (caramel): This fuel enriched to 7% is used in the OSIRIS reactor since 1980. After irradiation it is stored in PEGASE, an underwater storage facility in a CEA centre at Cadarache. UO_2 Fuel: This fuel enriched from 1.2 to 4% was used in EL.4, the 70 MW HWGCR prototype reactor, from 1967 to 1985. It will be kept in CASCAD, a dry storage facility at Cadarache, which will be in operation in 1989. UO_2-PuO_2 Fuel: This breeder reactor fuel which has been irradiated in RAPSODIE and which is still being used in the breeder reactor PHENIX (250 MWe) is reprocessed regularly. The plutonium thus recovered has been recycled several times in the reactor. Each fuel is thus either reprocessed or stored in facilities that have been specifically designed for research reactor fuels, and if necessary in a special container if the fuel elements are ruptured. (author). 2 figs.

4761 (IAEA-TECDOC–513, pp. 15-28) **Management of spent fuel from materials testing reactors in the United Kingdom.** Fellingham, L.R. (UKAEA Harwell Lab. (UK)). International Atomic Energy Agency, Vienna (Austria). Sep 1989. (CONF-8811290–: Technical committee on the safe management of spent fuel from research reactors, prototype power reactors and fuel from commercial power reactors that has been subjected to post-irradiation examinatio, Vienna (Austria), 28 Nov - 1 dec 198 In *Management of spent fuel from research and prototype power reactors and residues from post-irradiation examination of fuel. Proceedings of a technical committee meeting held in Vienna, 28 November - 1 December 1988.* Order Number DE90610069. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

Four MTR Reactors, DIDO, PLUTO, DMTR and HERALD have been constructed and operated in the UK. Of these DMTR and HERALD have now been shut down. The spent fuel elements from DIDO and PLUTO are treated by chemical reprocessing at Dounreay to recover the unused U^{235} and concentrate the fission product activity. All of the fuel from the DMTR reactor has already been reprocessed at Dounreay, whilst the final core from HERALD will be reprocessed soon. After reprocessing the first cycle raffinate, which contains the bulk of the fission products from the spent fuel, is currently stored in high integrity, stainless steel storage tanks which are housed below ground in heavily shielded vaults. A new plant has been constructed at Dounreay which will first neutralize with caustic soda and then immobilize this liquor in cement. The resulting products will then be kept in an engineered store until an intermediate level waste repository is available. The uranyl nitrate product from reprocessing is evaporated and then blended up by the addition of U^{235}. The uranium is then processed at Dounreay to make more MTR fuel, which is recycled to the remaining reactors. In the longer term uncertainty exists over the continued availability and economic viability of reprocessing, particularly if alternative,

cheaper sources of fuel are used. The alternative of long term storage of the spent fuel, followed by direct disposal, is therefore being examined as a contingency. A review of the options has concluded that the preferred route would involve the interim storage of the elements in special cans in a cross-flow, natural convection, air-cooled vault. The use of free standing, concrete storage casks to store the fuel would be significantly more expensive and is not favoured. (author). 2 refs, 7 figs.

4762 (IAEA-TECDOC–513, pp. 45-56) **Spent fuel management for research reactors.** Pahissa, M.H. de (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)); Pahissa Campa, J.; Devcic, N. International Atomic Energy Agency, Vienna (Austria). Sep 1989. (CONF-8811290–: Technical committee on the safe management of spent fuel from research reactors, prototype power reactors and fuel from commercial power reactors that has been subjected to post-irradiation examinatio, Vienna (Austria), 28 Nov - 1 dec 198 In *Management of spent fuel from research and prototype power reactors and residues from post-irradiation examination of fuel. Proceedings of a technical committee meeting held in Vienna, 28 November - 1 December 1988.* Order Number DE90610069. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

There are six research reactors in Argentina using fuel elements uranium enriched from 20 to 90%. Spent fuel elements management is limited to RA-1 (Argonaut type used for training) and RA-3 (for experimentation and radioisotope production), as for the others no changes have been carried out over the cores. The first core of RA-1 was reprocessed and the second core was manufactured with U_3O_8 obtained from reprocessing, and once spent was transferred to a dry storage. RA-3 is pool type and fuel elements are MTR enriched at 90% 24 fuel elements in the core. Up to now 238 fuel elements have been used with burn-up from 16 to 40% and about 8 gU per plate. At present RA-3 is being remodelled in order to be able to use fuel elements enriched to 20%. After decay in a pool at reactor building, they are transported to a wet storage facility for spent fuel elements. Control rods are treated in the same way. From 15 years of storage facility operation, it follows as a consequence that the proposed objectives have been fulfilled sufficiently well, as shown by radioactivity measurements on the water hole lines (5×10^{-4} Ci/m^3 of Cs-137) and the neutron interrogation method on the spent fuel elements tested presented values less than 10^{-8} gU/cm^3, that was considered acceptable. Nevertheless, some corrosion areas were observed. Program activities involve on one hand mainly new chemical and physical controls in order to optimize spent fuel storage and, on the other hand, the study of the corrosion observed with the aim to minimize it and to ensure safe storage. (author). 6 figs, 2 tabs.

4763 (IAEA-TECDOC–513, pp. 57-72) **Examples of CEA management of spent fuels from a prototype power reactor (PHENIX) and from commercial power reactors after post-irradiation examinations.** Guay, P. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). International Atomic Energy Agency, Vienna (Austria). Sep 1989. (CONF-8811290–: Technical committee on the safe management of spent fuel from research reactors, prototype power reactors and fuel from commercial power reactors that has been subjected to post-irradiation examinatio, Vienna (Austria), 28 Nov - 1 dec 198 In *Management of spent fuel from research and prototype power reactors and residues from post-irradiation examination of fuel. Proceedings of a technical committee meeting held in Vienna, 28 November - 1 December 1988.* Order Number DE90610069. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

The large CEA experience concerning the safe management of spent fuel from prototype power reactors and fuel from commercial power reactors that have been subjected to post irradiation examination, is illustrated by three examples: 1. Management of Spent Fuel from Phenix Reactor: A first series of reprocessing campaigns from which oxide fuel was realized between 1977 and 1983. The corresponding flowsheet, including: transportation, reception and reprocessing in TOP facility (Marcoule), wastes treatment, is presented. After the first series, it was decided to implement the new APM facility, well adapted to the specific reprocessing conditions of the Phenix spent fuel. The new resulting flowsheet is presented. 2. Management of Fuels from Commercial Power Reactors that have been Subjected to Post Irradiation Examination: 2.1 Example of PWR Spent Fuels. The CEA flowsheet includes: conditioning in a canister, cask transportation, temporary storage in Pegase pool facility then reprocessing in APM facility. A campaign was realized in 1988 concerning fuels from CAP reactor. 2.2 Example of Various Other Spent Fuels. For them, CEA has decided to build a special facility named STAR devoted to the pretreatment of the fuels before long time intermediate storage or reprocessing. That facility is equipped to realize: reception of various types of casks; opening of containers; thermal treatment of spent fuels if necessary; conditioning in various containers with closing by welding or crimping; control of non-leakage and non-contamination of the containers; storage before transportation towards: either industrial reprocessing facilities (Cogema), either pilot level reprocessing facilities (CEA : APM, ATALANTE); either long term intermediate dry storage (Cascad). (author). 5 figs.

4764 (IAEA-TECDOC–513, pp. 93-99) **Management of spent fuel from research reactors, prototype power reactors and fuel from fuel testing programs and PIE in hot cells.** Holmer, A. (Studsvik Nuclear, Nykoeping (Sweden)). International Atomic Energy Agency, Vienna (Austria). Sep 1989. (CONF-8811290–: Technical committee on the safe management of spent fuel from research reactors, prototype power reactors and fuel from commercial power reactors that has been subjected to post-irradiation examinatio, Vienna (Austria), 28 Nov - 1 dec 198 In *Management of spent fuel from research and prototype power reactors and residues from post-irradiation examination of fuel. Proceedings of a technical committee meeting held in Vienna, 28 November - 1 December 1988.* Order Number DE90610069. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

During the development of the Swedish nuclear power industry STUDSVIK has operated several prototype and research reactors. The first reactor in Sweden, R1 started in 1954, was decommissioned during the period 1981-1986 and the fuel elements, metallic uranium with aluminium cladding, are stored in Studsvik. The method for the long-term interim storage and final disposal or reprocessing is not yet decided. The 65 MW HpWR Agesta reactor was shut down in 1974. The fuel assemblies were transported to Studsvik for short-term storage under water. After approvals from the Swedish authorities the Agesta fuel is being transferred to CLAB starting in September 1987. The CLAB facility is built for interim storage of all spent fuel from Swedish reactors. Fuel testing programs and PIE in hot-cells have generated fuel waste now stored in a dry storage facility at Studsvik. This waste will be transferred to the hot-cell laboratory for encapsulation in stainless steel canisters. These canisters are loaded into transport boxes designed to fit a transport cask and the storage cassettes at CLAB. The encapsulation work is planned to start in 1989. (author). 2 refs, 2 figs.

4765 (IAEA-TECDOC–513, pp. 101-111) **Some aspects of WWER and BN irradiated fuel strength during storage and shipping.** Bibilashvili, Yu.K. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow (USSR)); Bogatyr', S.M.; Medvedev, A.V.; Novikov, V.V. International Atomic Energy Agency, Vienna (Austria). Sep 1989. (CONF-8811290–: Technical committee on the safe management of spent fuel from research reactors, prototype power reactors and fuel from commercial power reactors that has been subjected to post-irradiation examinatio, Vienna (Austria), 28 Nov - 1 dec 198 In *Management of spent fuel from research and prototype power reactors and residues from post-irradiation examination of fuel. Proceedings of a technical committee meeting held in Vienna, 28 November - 1 December 1988.* Order Number DE90610069. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

The paper discusses processes responsible for the core irradiated fuel condition. The extent of fuel clad damage is one of the factors that can limit the residence time of fuel assemblies (FA) in a storage pool and a shipping cask. Consideration is given to WWER and BN fuel storage conditions. It is shown that for BN fuels the interim holding of FA in an inreactor storage facility is of fundamental importance. It is shown that to develop methods of spent fuel management some properties of structural materials must be further studied. For shipping casks an approach is shown to determine the

maximum permissible fuel temperatures, the knowledge of which is important for a cask design. (author). 3 refs, 2 figs, 2 tabs.

4766 (IAEA-TECDOC–513, pp. 113-125) **Management of spent fuels in Spain.** Gravalos, J.M. (Empresa Nacional de Residuos Radiactivos, S.A., Madrid (Spain)); Manas-Diaz, L.; Uriarte, A. International Atomic Energy Agency, Vienna (Austria). Sep 1989. (CONF-8811290–: Technical committee on the safe management of spent fuel from research reactors, prototype power reactors and fuel from commercial power reactors that has been subjected to post-irradiation examinatio, Vienna (Austria), 28 Nov - 1 dec 198 In *Management of spent fuel from research and prototype power reactors and residues from post-irradiation examination of fuel. Proceedings of a technical committee meeting held in Vienna, 28 November - 1 December 1988.* Order Number DE90610069. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

From 1958 to 1987 four research reactors have been operating in Spain. At present, these four reactors are closed down and they have been declared to be decommissioned. The management of stored spent fuels is the first stage to be done. The different management options of these diverse kinds of spent fuels are presented in this report, including several irradiated fuel rods from the nuclear power station "Jose Cabrera" which were subjected to post irradiation examinations. A total of 165 spent fuel elements have been discharged from the JEN-1 reactor during its operational life. All these irradiated fuel elements have been or will be reprocessed, although different ways of management have been used throughout the years. The other three research reactors have used the same fuel elements during all their operational life. These fuel elements have a very low radioactive level. Twenty-two irradiated fuel rods from the nuclear power station "JOSE CABRERA-ZORITA" (PWR type) were used for post irradiation studies and examination. Their burn-up are between 20,000 and 60,000 MWD/tU. Handling, storage, conditioning, transportation, reprocessing, etc., for the different fuels are analyzed in this paper from the Spanish experience and point of view. (author). 3 figs.

0510 Economic, Industrial, and Business Aspects

Refer also to citation(s) 4759, 5169

0520 Waste Management

Refer also to citation(s) 4758, 4759, 4761, 4763, 4764, 4766, 4877, 4879, 4882, 4883, 4895, 4897, 5096, 5501, 5540, 5607, 5627, 5628, 5663, 5851, 5852, 5853, 5890, 5971, 6450

4767 (AEEW-R–2058) **Dispersal of contaminants in heterogeneous aquifers: a review of methods of estimating scale dependent parameters.** Farmer, C.L. UKAEA Atomic Energy Establishment, Winfrith (UK). Oil Recovery Projects Div. Feb 1986. 61p. Order Number DE90610331. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

The design and assessment of underground waste disposal options requires modelling the dispersal of contaminants within aquifers. The logical structure of the development and application of disposal models is discussed. In particular we examine the validity and interpretation of the gradient diffusion model. The effective dispersion parameters in such a model seem to depend upon the scale on which they are measured. This phenomenon is analysed and methods for modelling scale dependent parameters are reviewed. Specific recommendations regarding the modelling of contaminant dispersal are provided. (author).

4768 (AERE-R–13377) **Joule ceramic melter research report for 1987/88 and 1988/89.** Morris, J.B. (UKAEA Harwell Lab. (UK). Chemical Engineering Div.); Hollinrake, A.; Wall, G.P.; Dalton, J.T.; Paige, E.L.; Sutcliffe, P.W. UKAEA Harwell Lab. (UK). Chemistry Div.; Department of the Environment, London (UK). Feb 1989. 143p. (DOE-RW–89.035). Available from H.M. Stationery Office, London, price Pound 24.25.

This document reports the final two years of a programme to evaluate the Joule Ceramic Melter as an option for vitrifying Dounreay high level waste. The evaluation has not been completed owing to changes in policy. The report includes reviews of (i) earlier work, (ii) overseas applications of JCM technology, (iii) implications of the results on JCM design. The work has concentrated on sedimentation problems in PFR waste glass using the Experimental Test Melter. The nature of the sediments has been determined. Their effect on electrical conductivity is less marked than in Magnox waste glass. Gas sparging was not very effective at controlling sedimentation. Two phenomena occurred in the melter which are not yet understood. (1) The electrodes suffered corrosion at the sides and in the centre to an extent about 10 times greater than expected based on the glass temperature. Metallography suggested the corroded regions had experienced temperatures about 200^{0}C higher than those of the glass. (2) The glass temperatures fluctuated randomly. (author).

4769 (BNL–43449) **The effects of temperature on the leaching behavior of cement waste forms: The cement/sodium sulfate system.** Fuhrmann, M.; Pietrzak, R.; Heiser, J.; Franz, E.M.; Colombo, P. Brookhaven National Lab., Upton, NY (USA). Oct 1989. 7p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC02-76CH00016. (CONF-891119–20: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989). Order Number DE90003641. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The leaching mechanisms of simulated low-level radioactive waste forms are being determined as support for development of an accelerated leach test. Two approaches are being used: (1) comparisons of leaching data with results of a model that describes diffusion from a finite cylinder, and (2) observation of the leaching process at temperatures between 20°C and 65°C. To provide results that can be used for modeling, leaching at elevated temperatures must change neither the leaching mechanism nor the structural controls of leaching such as the porosity. Releases of ^{137}Cs, ^{85}Sr, calcium, sodium and potassium from portland cement containing sodium sulfate, as a simulated evaporator sludge, have been determined under a variety of experimental conditions. Data from the leach tests were compared to model results for diffusion from the finite cylinder. While most leaching appears to be diffusion controlled, notable exceptions occur. For all samples activation energies ranging between 6 and 11 Kcal/mole have been calculated from the relationship of the effective diffusion coefficient to increasing temperature, close to the expected value of 5 Kcal/mole for diffusion. 11 refs., 4 figs., 2 tabs.

4770 (CEGB-SRD-R–489) **Radioactive waste disposal by UKAEA establishments during 1986 and associated environmental monitoring results.** Phillips, F. (comp.). UKAEA Safety and Reliability Directorate, Culcheth (UK). Dec 1988. 66p. Available from HMSO, London, Price Pound 6.00.

This report gives details of the radioactive solid, liquid and gaseous wastes disposed of by the United Kingdom Atomic Energy Authority in 1986 and summarises the results of environmental surveys designed to monitor their impact. (author).

4771 (CONF-891119–29) **Speciation of Pu(VI) in near-neutral to basic solutions via spectroscopy.** Shigeo Okajima; Reed, D.T.; Mazer, J.J.; Sabau, C.A. Argonne National Lab., IL (USA). 1989. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Materials Research Society fall meeting: Boston, MA (USA); 27 Nov - 2 dec 1989. Order Number DE90003786. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The high sensitivity technique of laser photoacoustic spectroscopy and optical absorption spectroscopy were utilized to investigate the hydrolysis of Pu(VI) in perchlorate media. Absorption bands attributed to the hydrolysis of Pu(VI) were characterized in the pH = 6-8 regime which is of most interest to the proposed repository site at Yucca Mountain. Evidence was presented that supported the assignment of the polynuclear species (640 nm species) reported previously [1] as $PuO_3(OH)_5^{+1}$. Some temperature-dependent LPAS spectra are reported. The results obtained were compared to the predicted speciation of the geochemical code EQ3NR. 14 refs., 4 figs., 3 tabs.

4772 (DOE/FTR–90003151) **[Radioactive waste management]: Foreign trip report, October 20–29, 1989.** Colombo, P. Brookhaven National Lab., Upton, NY (USA). 11 Nov 1989. 12p.

Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC02-76CH00016. Order Number DE90003151. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The conference technical program and exhibition was held at the Kyoto International Conference Hall located in the north area of Kyoto. The technical program of the conference consisted of presentations of approximately 200 technical papers, organized in twenty oral and two poster sessions. Approximately one half of the technical papers dealt with LLW and ILW and the other half with HLW and spent fuel topics. The various technical conference sessions are given in Appendix II. There were about 20 exhibitors participating, mostly from Europe and Japan.

4773 (DOE/RL–89-09-Draft-Rev.A) **RCRA Facility investigation/corrective measures study work plan for the 100-DR-1 operable unit, Hanford Site, Richland, Washington: Draft Revision A.** Westinghouse Hanford Co., Richland, WA (USA). Oct 1989. 436p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-87RL10930. Order Number DE90003498. Available from NTIS, PC A19/MF A01 - OSTI; GPO Dep.

The Resource Conservation and Recovery Act (RCRA) provides for corrective action at solid waste management units located at permitted RCRA facilities, regardless of when waste was received at a unit. The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) focuses on waste site cleanups whenever there is a release or substantial threat of a release to the environment of a hazardous substance, pollutant, or contaminant. High priority sites are placed on a National Priorities List (NPL) by the US Environmental Protection Agency (EPA) in accordance with CERCLA. CERCLA requires that federal facilities that qualify be placed on the NPL. The 100 Area of the Hanford Site is one of four Hanford aggregate areas currently proposed for the NPL. This work plan was prepared in accordance with Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (Interim Final) (EPA 1988a). However, in accordance with the Hanford Federal Facility Agreement and Consent Order, the EPA and State of Washington Department of Ecology (Ecology) have determined that the 100-DR-1 operable unit will be addressed under RCRA corrective action authority. The EPA and Ecology have determined that the EPA guidance for conducting a remedial investigation/feasibility study under CERCLA may be used at the Hanford Site in the performance of a RCRA facility investigation/corrective measures study. Therefore, although RCRA terminology has been used where appropriate, the content and format of this work plan conform to EPA guidance for CERCLA activities.

4774 (DOE/RL/01030–T9) **Preliminary hydrologic testing results: McCoy Canyon flow-top, DC-7, 3410.2-3477.6 feet and DC-8: 3407.0-3480.4 feet.** Jackson, R.L.; Moak, D.J.; Spane, F.A. Jr. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. 3 May 1982. 23p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This report describes the hydrologic tests performed for an interflow zone within the Grande Ronde Basalt at Boreholes DC-7/8. The results, along with hydrologic data from several boreholes, will provide input for hydrologic modeling of groundwater flow and solute transport to assess the feasibility of siting a nuclear waste repository beneath the Hanford Site. 7 figs., 1 tab.

4775 (DOE/RL/01030–T15) **Assessment of the Rockwell Hanford isotope and geochemical hydrology program, Pasco Basin, Washington.** Bentley, H.W. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations; Hydro Geo Chem., Inc., Tucson, AZ (USA). 12 Aug 1982. 15p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This brief report contains my observations concerning the Rockwell Hanford isotope and geochemical hydrology program at the Hanford Site, Columbia River Basalts. The purpose of this report is to review the isotope and geochemistry data base and interpretation, to criticize the program, and to offer suggestions for improvements and/or additional data collection. 10 refs.

4776 (DOE/RL/01030–T19) **A review of drilled shaft sealing for the Basalt Waste Isolation Project.** Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. 11 Sep 1981. 43p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

Questions have been raised concerning the ability of the drillers of the exploratory shaft for the Basalt Waste Isolation program to develop an effective seal against water inflow down the annular space between the shaft casing and shaft wall into the mined chambers. We understand the need for shaft integrity and the concern of those responsible for the shaft planning. The purpose of this report is to give documentation to allay the fears of those who may have questions remaining in their minds concerning the prospects for a dry shaft. Included in this report are discussions of five projects where shaft sealing was effective in drilled shafts and one project where the material which is recommended for the exploratory shaft was used effectively in a conventional shaft. Also discussed is the recommended multitier approach toward shaft sealing which will, if adopted, use all of the current state of the art techniques to assure the watertightness of the shaft. It should be pointed out that none of the projects described here used all of the safeguards which are recommended in this program. If any of the materials and procedures recommended here are omitted, then of course the possibility increases for water migration through the casing-borehole annulus. It is our considered opinion that if the program recommended is adopted there will be no water inflow into the shaft, but if we are wrong or if, through human error, the program is not executed correctly, that we have devices and procedures available to us which will facilitate remedial work to perfect seal in the shaft. 4 refs., 3 figs., 1 tab.

4777 (DOE-RW–89.048) **Equilibrium leach testing of Magnox swarf and sludge.** Amin, A. (UKAEA Northern Research Labs. Windscale, Seascale (UK)); Angus, M.J.; Kirkham, I.A.; Tyson, A. Department of the Environment, London (UK). Oct 1988. 32p. (ND-R–1543(W);ILWRP–86-P10). Order Number DE90610326. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A static equilibrium leach test has been developed to simulate repository conditions after ground water has penetrated the near field barrier. The repository components - waste, matrix and backfill - have been equilibrated with water for up to one year. Leachates were analysed for U, Pu, Np^{237}, Am^{241}, Cs^{137}, Sr^{90}, Tc^{99}, I^{129} and C^{14}. Results are presented for leaching from Magnox fuel cladding wastes using a combination of matrices, backfills and atmospheric conditions. The equilibrium concentrations were generally very low and have been compared with the concentration of each isotope in drinking water that would give an adult an annual effective dose equivalent of 0.1mSv. (author).

4778 (ENEA-RT-COMB–89-06) **CMPO, a new extractant for actinides. A review of the currently available literature.** Liansheng, W.; Gasparini, G.M. ENEA, Casaccia (Italy). Dipt. Ciclo del Combustibile. Jun 1989. 55p. Order Number DE90724679. Available from NTIS (US Sales Only), PC A04/MF A01.

This report describes the extractive properties of dialkyl-N, N-dialkyl carbamoyl methyl phosphinoxides, a series of extractants for liquid-liquid extraction techniques, suitable for actinides separation, in any valence state. These extractants were especially studied to treat effluents contaminated with alpha emitters. The technical reasons for which n-octyl(phenyl)-N,N-diisobutyl carbamoyl methyl phosphinoxide (CMPO) and its best experimental conditions were chosen, are examined. CMPO is the extractant utilized to treat, by means of the TESEO Process studied and verified in the ENEA (Italian Commission for Alternative Energy Sources) laboratories, the alpha contaminated effluents of the Casaccia Energy Research Center Plutonium Laboratory.

4779 (ENEA-RT-COMB–89-08) **Selected separation of actinides and long lived fission products from aged liquid wastes produced by the EUREX plant at Saluggia (Italy).** Pietrelli, L.; Grossi, G.; Troiani, F. ENEA, Casaccia (Italy). Dipt. Ciclo del Combustibile; Comitato Nazionale per l'Energia Nucleare, Saluggia (Italy). Dipt. Ciclo del Combustibile. Jun 1989. 20p. (CONF-880510–5: IAEA-ECC international symposium on the management of low and intermediate level radioactive wastes, Stockholm (Sweden), 16-20 May 1988). Order Number DE90724681. Available from NTIS (US Sales Only), PC A03/MF A01.

Paper presented at the IAEA/CEC international symposium on management of low and intermediate level waste, Stockholm, Sweden, May 1988.

A chemical process for the selective separation of actinides and long lived fission products from aged MTR type liquid wastes is described. To perform this selective separation, some chemical procedures such as precipitation and ion exchange, both in acidic and alkaline media, were investigated, mainly at the laboratory scale, using simulatated and traced waste solutions. To confirm the results obtained with simulated or traced solutions, additional tests with true MTR wastes are in progress in the analytical hot cell of the ENEA EUREX pilot plant in Saluggia (Italy). With all these results, it is possible to perform a preliminary selection of the reference process. Further larger scale information will be available after experimental runs on a cold pilot plant, named SERSE, designed and built at Saluggia for an engineering scale demonstration of the chemical separation process.

4780 (ENEA-RT-PAS–88-30) **Use of an Italian pozzolanic cement for the solidification of bead ion exchange resins.** De Angelis, G. ENEA, Casaccia (Italy). Dipt. Protezione Ambientale e Salute dell'Uomo. Mar 1989. 41p. Order Number DE90724695. Available from NTIS (US Sales Only), PC A03/MF A01.

Measurements of swelling pressure in solidified medium-level radwastes were made together with an evaluation of the volume changes of resin beads due to ion exchange and of weight increase as a function of relative humidity. Ion exchange, which continues even after incorporation in a cement matrix was also evidenced. The conclusion was drawn that a three component diagram (water-dry resin-cement) has to be prepared in order to identify better formulations. With this in mind, the optimum waste loading of 11.5 wt% of dry resin was chosen to be incorporated into an Italian pozzolanic cement (425 type). Several properties of the final waste form were investigated, ranging from mechanical (crushing strength, tensile strength, flexural strength, ultrasonic pulse velocity, elastic modulus and Poisson ratio), to thermal stability, radiation stability, permeability, leachability and resistance to bacterial attack. Dimensional stability was also measured with the aim of examining the expansion phenomena which can take place in the presence of resin beads. The data obtained are encouraging for future applications of the type 425 cement tested in the field of radwastes. An attempt to explain the performance of this binder, based on its intrinsic properties, was also made.

4781 (EUR–11775) **Performance assessment of geological isolation systems for radioactive waste. Summary.** Cadelli, N. (Commission of the European Communities, Ispra (IT). Joint Research Centre); Cottone, G.; Orlowski, S.; Bertozzi, G.; Girardi, F.; Saltelli, A. Commission of the European Communities, Luxembourg (Luxembourg). 1988. 268p. Available from NTIS (US Sales Only), PC A12/MF A01.

The report summarizes the studies undertaken in the framework of the project PAGIS of the CEC Research Programme on radioactive waste. It concerns the analysis of the safety performances on the deep disposal of vitrified high level waste in four geological options: clay, granite, salt and the sub-seabed. The report describes the selection of sites and scenarios with the corresponding data base. It outlines the methodology adopted for determining the safety level which can be achieved with an underground disposal system for HLW. Two complementary approaches have been implemented: (1) a set of deterministic calculations for evaluating the dose rates as a function of time and for analysing local sensitivity on single parameters or components of the disposal system, (2) stochastic calculations for both uncertainty and global sensitivity analyses. For each option, the report presents the most significant results, obtained from the calculations at specific sites-from both the approaches. Apart the dose rates and their expectation values, the predominant radionuclides and pathways to man are identified as well as the most sensitive parameters and phenomena. The final chapter concludes stating the feasibility of safe disposal of HLW in underground repositories. This document is one of a set of 5 reports covering a relevant project of the European Community on a nuclear safety subject having very wide interest. The five volumes are: the summary (EUR 11775-EN), the clay (EUR 11776-EN), the granite (EUR 11777-FR), the salt (EUR 11778-EN) and the subseabed (EUR 11779-EN).

4782 (IAEA-TECDOC–513, pp. 39-43) **Spent fuel from research reactors as the only high level waste in a country: The case of Greece.** Synetos, S. (National Research Centre for the Physical Sciences Democritos, Athens (Greece). Inst. of Nuclear Technology-Radiation Protection). International Atomic Energy Agency, Vienna (Austria). Sep 1989. (CONF-8811290–: Technical committee on the safe management of spent fuel from research reactors, prototype power reactors and fuel from commercial power reactors that has been subjected to post-irradiation examinatio, Vienna (Austria), 28 Nov - 1 dec 198 In *Management of spent fuel from research and prototype power reactors and residues from post-irradiation examination of fuel. Proceedings of a technical committee meeting held in Vienna, 28 November - 1 December 1988.* Order Number DE90610069. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

The only nuclear activity in Greece producing substantial quantities of high level radioactive waste, is the operation of the "Demokritos' Research Reactor. It is an open pool type research reactor operated at 5 MW thermal power since 1961. It is fueled by MTR type fuel elements, each containing approximately 200 gr. of 93% enriched uranium. The fuel plates are made of an U-Al alloy enclosed in an Al cladding. According to the core management scheme followed any fuel element is shuffled through all the grid positions and is removed from service when it reaches a burn-up of 30%. The total throughput is thus 6 to 8 spent fuel elements per year. The spent fuel management scheme includes the following stages: initial storage for cooling in the storage end of the reactor pool for about 6 months, transportation with a shielded cask to the long-term storage pool where the elements remain for periods of up to 10 years, and finally transportation to a secondary pool outside the reactor hall where the top and bottom end fittings of the elements are cut prior to transportation to the reprocessing plant in the USA. The enriched uranium recovered by reprocessing remains in the USA, and the Greek side is provided with a credit, usually used against the purchase of fresh fuel. The above spent fuel management scheme apart from assuring that no high level waste remains in the country, complies with the non-proliferation treaty and in parallel eases the safeguards and Physical Security burden. (author). 3 figs.

4783 (INIS-BR–1733, pp. 129-148) **Storage of radioactive wastes.** Rosental, J. de J. (Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil)). Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1977. (In Portuguese). In *Environmental protection and safety of nuclear facilities.* Order Number DE90608315. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

A study about radioactive waste storage from Angra-1 reactor is presented.

4784 (INIS-BR–1758) **Disposal of high level radioactive wastes in geological formations.** Martins, L.A.M. (Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil)); Carvalho Bastos, J.P. de. Associacao Brasileira de Geologia de Engenharia, Sao Paulo, SP (Brazil). 1978. 11p. (In Portuguese). (CONF-7811229–: 3. Brazilian Congress of Engineering Geology, Sao Paulo (Brazil), Nov 1978). Order Number DE90608843. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The disposal of high-activity radioactive wastes is the most serious problem for the nuclear industry. Among the solutions, the disposal of wastes in approriated geological formations is the most realistic and feasible. In this work the methods used for geological disposal, as well as, the criteria, programs and analysis for selecting a bite for waste disposal are presented.

4785 (INIS-mf–11562, pp. 92-93) **Radiation protection on regional radioactive waste burial site at Mochovce.** Seliga, M. (Elektrarna, Mochovce (Czechoslovakia)). Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia).

Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. RADIOACTIVE WASTE DISPOSAL/radiation protection; RADIATION MONITORING; RADIOACTIVITY

4786 (LA-UR–89-3701) **Radionuclide migration studies at the Nevada Test Site.** Thompson, J.L. Los Alamos National Lab., NM (USA). [1989]. 12p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-891206–4: International chemical congress of Pacific Basin Society symposium on polymer rheology and processing (PACIFICHEM '89), Honolulu, HI (USA), 17-22 Dec 1989). Order Number DE90003169. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The United States government routinely tests nuclear devices at the Nevada Test Site (NTS) in southern Nevada. A significant amount of radioactive material exists underground at the NTS with no containers or engineered barriers to inhibit its subsequent migration. The Department of Energy has sponsored for many years a research program on radionuclide movement in the geologic media at this location. Goals of this research program are to measure the extent of movement of radionuclides away from underground explosion sites and to determine the mechanisms by which such movement occurs. This program has acquired significance in another aspect of nuclear waste management because of the Yucca Mountain Project. Yucca Mountain at the NTS is being intensively studied as the possible site for a mined repository for high level nuclear waste. The NTS provides a unique setting for field studies concerning radionuclide migration; there is the potential for greatly increasing our knowledge of the behavior of radioactive materials in volcanogenic media. This review summarizes some of the significant findings made under this research program at the NTS and identifies reports in which the details of the research may be found. 36 refs., 4 figs.

4787 (LA-UR–89-3702) **Size determinations of plutonium colloids using autocorrelation photon spectroscopy.** Triay, I.R.; Rundberg, R.S.; Mitchell, A.J.; Ott, M.A.; Hobart, D.E.; Palmer, P.D.; Newton, T.W.; Thompson, J.L. Los Alamos National Lab., NM (USA). [1989]. 15p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract W-7405-ENG-36. (CONF-891120–6: Migration '89: 2nd international conference on chemistry and migration behavior of actinides and fission products in the geosphere, Monterey, CA (USA), 6-10 Nov 1989). Order Number DE90003168. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Autocorrelation Photon Spectroscopy (APS) is a light-scattering technique utilized to determine the size distribution of colloidal suspensions. The capabilities of the APS methodology have been assessed by analyzing colloids of known sizes. Plutonium(IV) colloid samples were prepared by a variety of methods including: dilution; peptization; and alpha-induced auto-oxidation of Pu(III). The size of theses Pu colloids was analyzed using APS. The sizes determined for the Pu colloids studied varied from 1 to 370 nanometers. 7 refs., 5 figs., 3 tabs.

4788 (LA-UR–89-3734) **Observation of time dependent dispersion in laboratory scale experiments with intact tuff.** Rundberg, R.S.; Triay, I.R.; Ott, M.A.; Mitchell, A.J. Los Alamos National Lab., NM (USA). 1989. 14p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract W-7405-ENG-36. (CONF-891120–7: Migration '89: 2nd international conference on chemistry and migration behavior of actinides and fission products in the geosphere, Monterey, CA (USA), 6-10 Nov 1989). Order Number DE90003190. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The migration of radionuclides through intact tuff was studied using tuff from Yucca Mountain, Nevada. The tuff samples were both highly zeolitized ash-fall tuff from the Calico Hills and densely welded devitrified tuff from the Topopah Springs member of the Paintbrush tuff. Tritiated water and pertechnetate were used as conservative tracers. The sorbing tracers ^{85}Sr, ^{137}Cs, and ^{133}Ba were used with the devitrified tuff only. Greater tailing in the elution curves of the densely welded tuff samples was observed that could be fit by adjusting the dispersion coefficient in the conventional Advection Dispersion Equation, ADE. The curves could be fit using time dependent dispersion as was previously observed for sediments and alluvium by Dieulin, Matheron, and de Marsily. The peak of strontium concentration was expected to arrive after 1.5 years based on the conventional ADE and assuming a linear K_d of 26 ml/g. The observed elution had significant strontium in the first sample taken at 2 weeks after injection. The peak in the strontium elution occurred at 5 weeks. The correct arrival time for the strontium peak was achieved using a one dimensional analytic solution with time dependent dispersion. The dispersion coefficient as a function of time used to fit the conservative tracers was found to predict the peak arrival of the sorbing tracers. The K_d used was the K_d determined by the batch method on crushed tuff. 23 refs., 9 figs., 2 tabs.

4789 (LA-UR–89-3736) **A passive-active neutron device for assaying remote-handled transuranic waste.** Estep, R.J.; Coop, K.L.; Deane, T.M.; Lujan, J.E. Los Alamos National Lab., NM (USA). [1989]. 13p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-891197–4: Topical meeting on non-destructive assay of radioactive waste, Cadarache (France), 20-22 Nov 1989). Order Number DE90003189. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A combined passive-active neutron assay device was constructed for assaying remote-handled transuranic waste. A study of matrix and source position effects in active assays showed that a knowledge of the source position alone is not sufficient to correct for position-related errors in highly moderating or absorbing matrices. An alternate function for the active assay of solid fuel pellets was derived, although the efficacy of this approach remains to be established. 4 refs., 7 figs., 1 tab.

4790 (LBL–24967) **The applicability of expert systems to risk analysis for waste disposal problems.** Billaux, D.; Uszynski, M.; Benson, S.M. Lawrence Berkeley Lab., CA (USA). Mar 1988. 77p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC03-76SF00098. Order Number DE90002597. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This report investigates the specificity of expert system tools in view of their application to nuclear waste disposal and related activities. The nature of expert systems and their unique characteristics are first discussed, and several examples are given. The trial and error process used for building them is then outlined. The type of problems they can solve is emphasized. We have chosen one problem, well test interpretation, as an example and begun the development of a prototype system. Upon completion, this program will interpret the pressure versus time curve obtained during a pumping test in order to draw conclusions about the type of hydrologic regime underground and provide an estimate of the relevant hydraulic parameters. The current state of this effort is described, and a listing of the program in LISP and ART languages is given in the appendix. 11 refs., 11 figs.

4791 (LBL–27578) **Semi-analytical solutions for flow problems in unsaturated porous media.** Zimmerman, R.W.; Bodvarsson, G.S. Lawrence Berkeley Lab., CA (USA). Aug 1989. 24p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-891208–20: Winter annual meeting of the American Society of Mechanical Engineers, San Francisco, CA (USA), 10-15 Dec 1989). Order Number DE90000556. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Semi-analytical solutions are developed for two unsaturated flow problems that are relevant to characterizing the hydrological behavior of Yucca Mountain, the site of a proposed nuclear waste repository. The "integral" or "boundary-layer" approach is used to find a closed-form approximate solution for absorption of water from a saturated fracture into an unsaturated semi-infinite formation. This solution is then programmed into a numerical code as a source/sink term for fracture elements, and used to study the problem of flow along a fracture with transverse leakage to the rock matrix. 21 refs., 7 figs.

4792 (NSS/R–153) **Talbot's method for the numerical inversion of Laplace transforms: an implementation for personal computers.** Garratt, T.J. (UKAEA Harwell Lab. (UK). Theoretical Physics Div.). United Kingdom Nirex, Ltd., Harwell (UK). May 1989.

41p. (AERE-R–12417). Order Number DE90610335. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Safety assessments of radioactive waste disposal require efficient computer models for the important processes. The present paper is based on an efficient computational technique which can be used to solve a wide variety of safety assessment models. It involves the numerical inversion of analytical solutions to the Laplace-transformed differential equations using a method proposed by Talbot. This method has been implemented on a personal computer in a user-friendly manner. The steps required to implement a particular transform and run the program are outlined. Four examples are described which illustrate the flexibility, accuracy and efficiency of the program. The improvements in computational efficiency described in this paper have application to the probabilistic safety assessment codes ESCORT and MASCOT which are currently under development. Also, it is hoped that the present work will form the basis of software for personal computers which could be used to demonstrate safety assessment procedures to a wide audience. (author).

4793 (NSS/R–154) **Solution methods for compartment models of transport through the environment using numerical inversion of Laplace transforms.** Garratt, T.J. (UKAEA Harwell Lab. (UK). Theoretical Physics Div.). United Kingdom Nirex, Ltd., Harwell (UK). May 1989. 33p. (AERE-R–12644). Order Number DE90610336. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Compartment models for the transport of radionuclides in the biosphere are conventionally solved using a numerical time-stepping procedure. This report examines an alternative method based on the numerical inversion of Laplace transforms, which is potentially more efficient and accurate for some classes of problem. The central problem considered is the most efficient and robust technique for solving the Laplace-transformed rate equations. The conclusion is that Gaussian elimination is the most efficient and robust solution method. A general compartment model has been implemented on a personal computer and used to solve a realistic case including radionuclide decay chains. (author).

4794 (NUREG/CR–5184) **User's manual for the MIGRAT pre- and postprocessor.** Sharp, R.D. (Oak Ridge National Lab., TN (USA)); Witten, A.J. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Low-Level Waste Management and Decommissioning; Oak Ridge National Lab., TN (USA). Nov 1989. 123p. Sponsored by Nuclear Regulatory Commission. (ORNL/TM–10831). Available from NTIS, PC A07/MF A01 - GPO - OSTI.

MIGRAT is a state-of-the-art computer code that numerically solves Richard's equation for the migration of moisture in the unsaturated zone and the advective diffusion equation for the associated movement of contaminants. This code utilizes the integral form of these governing equations. This formulation allows the use of polygonal computational cells which can provide an accurate representation of the modeled region. The penalty for this realism is the extensive input data necessary for model applications. In order to render the MIGRAT code more suitable for routine applications, an interactive preprocessor has been developed which allows a user to enter input data rapidly and in a more convenient format. The preprocessor is designed for use on a personal computer to allow the user to develop, modify, and display input data prior to its transmission to a mainframe for MIGRAT execution. Model output can be captured by the personal computer for display utilizing the preprocessor's graphics software. 2 refs., 32 figs., 20 tabs.

4795 (NUREG/CR–5412) **Modeling one-dimensional radionuclide transport under time-varying fluid-flow conditions.** Gelbard, F. (Sandia National Labs., Albuquerque, NM (USA)). Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Sandia National Labs., Albuquerque, NM (USA). Nov 1989. 28p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (SAND–89-1521). Available from NTIS, PC A02/MF A01 - GPO; OSTI; INIS.

An exact solution is derived for one-dimensional radionuclide transport under time-varying fluid-flow conditions including radioactive decay but with the approximation that all radionuclides have identical retardation factors. The solution is used to obtain exact expressions for the cumulative radionuclide mass transported past a fixed point in space over a given time period, and to assess the effects of a periodic perturbation and a step change on the fluid-flow velocity and dispersion coefficient. 14 refs., 3 figs., 3 tabs.

4796 (ORNL/Sub–89-AJ015GA1/1) **Assessment of potential worker exposure for the tumulus disposal demonstration project: Fiscal year 1989 mid-year report, October 1, 1988–March 31, 1989.** Garland, S.B. II (Oak Ridge National Lab., TN (USA). Environmental Sciences Div.); Styers, D.R. Oak Ridge National Lab., TN (USA); Automated Sciences Group, Inc., Oak Ridge, TN (USA). May 1989. 23p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OR21400. Order Number DE90004418. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Disposal operations for the Tumulus Disposal Demonstration Project (TDDP) have been on-going since September 1987. This report documents the radiological exposures received by the disposal crew as they prepared and emplaced solid Low-Level Waste (LLW) onto the Tumulus pad during the first half of FY 1989 (October 1, 1988, to March 31, 1989). The effect of the TDDP on the environment is also assessed. The radiological information collected during this time frame included unit operations monitoring, exposure rate surveys of the TDDP site, the determination of transferable contamination levels on the pad and on the exterior surfaces of the primary and secondary disposal packages, and the collection and analyses of particulate air samples to determine the short-lived activities in the air. The data were compared to the data collected during FY 1988. During FY 1988, each member of the crew received approximately 0.4 mrem/hr/vault (4 μSv/hr/vault). The data from the first half of FY 1989 indicated that each member of the disposal crew received a net dose equivalent at the rate of approximately 0.5 mrem/hr/vault (5 μSv/hr/vault). These dose equivalent rates are approximately 20% of the allowable dose equivalent rate of 2.5 mrem/hr (25 μSv/hr). These dose equivalent rates fulfill DOE's commitment to ALARA. Also, the disposal activities associated with the TDDP have not caused any radiological impact on the environment at the TDDP site. 3 tabs.

4797 (ORNL/TM–11292) **Radioactive waste vitrification: A review.** Cole, L.L.; Fields, D.E. Oak Ridge National Lab., TN (USA). Aug 1989. 31p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90003378. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The research and development of an immobilization process for the containment of nuclear high-level liquid waste has been underway for well-over the past four decades. The method that has become the state-of-the-art is the liquid-fed ceramic melter process which converts a mixture of high-level liquid waste and glass forming frit to a borosilicate glass product. This report gives a chronological review of the various vitrification processes starting with the very first reported process in 1960. Information on the early methods of frit selection as well as information on the currently computerized method are presented. The importance of all these parameters is discussed with regard to product durability. 26 refs., 8 figs., 1 tab.

4798 (ORNL/TM–11293) **In situ vitrification: A review.** Cole, L.L.; Fields, D.E. Oak Ridge National Lab., TN (USA). Nov 1989. 21p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90003379. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The in situ vitrification process (ISV) converts contaminated soils and sludges to a glass and crystalline product. The process appears to be ideally suited for on site treatment of both wet and dry wastes. Basically, the system requires four molybdenum electrodes, an electrical power system for vitrifying the soil, a hood to trap gaseous effluents, an off-gas treatment system, an off-gas cooling system, and a process control station. Mounted in three transportable trailers, the ISV process can be moved from site to site. The process has the potential for treating contaminated soils at most 13 m deep. The ISV project has won a number of outstanding achievement awards. The process has also been patented with exclusive worldwide rights being granted to Battelle Memorial Institute for nonradioactive applications. While federal applications still belong to the Department of Energy, Battelle transferred the rights of ISV for non-federal government, chemical hazardous wastes to a separate

corporation in 1989 called Geosafe. This report gives a review of the process including current operational behavior and applications.

4799 (PB–89-872444/XAB) **Defense Waste Processing facility (DWPF): The vitrification of high-level nuclear waste. January 1980-September 1989 (Citations from the NTIS database). Report for January 1980-September 1989.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 113p. Available from NTISPC N01/MF N01.

This bibliography contains citations concerning the United States' first production-scale facility and the world's largest plant for the vitrification of high-level radioactive nuclear wastes (HLW). Starting with the selection of borosilicate glass as the reference waste form in 1977, the citations present the history of the development including R&D projects and the actual construction of the production facility at the DOE Savannah River Plant (SRP). Slated to begin operation in 1990, over 33 million gallons of HLW will be stored in stainless steel canisters using many techniques and innovative processes and items of equipment described by this bibliography. (Contains 203 citations fully indexed and including a title list.)

4800 (PNL–7121) **Leach tests on grouts made with actual and trace metal-spiked synthetic phosphate/sulfate waste.** Serne, R.J.; Martin, W.J.; LeGore, V.L.; Lindenmeier, C.W.; McLaurine, S.B.; Martin, P.F.C.; Lokken, R.O. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 178p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE90002630. Available from NTIS, PC A09/MF A01; OSTI; INIS; GPO Dep.

Pacific Northwest Laboratory conducted experiments to produce empirical leach rate data for phosphate-sulfate waste (PSW) grout. Effective diffusivities were measured for various radionuclides (^{90}Sr, ^{99}Tc, ^{14}C, ^{129}I, ^{137}Cs, ^{60}Co, ^{54}Mn, and U), stable major components (NO_3^-, SO_4^{2-}, H_3BO_3, K and Na) and the trace constituents Ag, As, Cd, Hg, Pb, and Se. Two types of leach tests were used on samples of actual PSW grout and synthetic PSW grout: the American Nuclear Society (ANS) 16.1 intermittent replacement leach test and a static leach test. Grout produced from both synthetic and real PSW showed low leach rates for the trace metal constituents and most of the waste radionuclides. Many of the spiked trace metals and radionuclides were not detected in any leachates. None of the effluents contained measurable quantities of ^{137}Cs, ^{60}Co, ^{54}Mn, ^{109}Cd, ^{51}Cr, ^{210}Pb, ^{203}Hg, or As. For those trace species with detectable leach rates, ^{125}I appeared to have the greatest leach rate, followed by ^{99}Tc, ^{75}Se, and finally U, ^{14}C, and ^{110m}Ag. Leach rates for nitrate are between those for I and Tc, but there is much scatter in the nitrate data because of the very low nitrate inventory. 32 refs., 6 figs., 15 tabs.

4801 (PNL–7153) **Hanford protective barriers program: Status of asphalt barrier studies - FY 1989.** Freeman, H.D.; Gee, G.W. Pacific Northwest Lab., Richland, WA (USA). Nov 1989. 23p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE90003401. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The Hanford Protective Barrier Program is evaluating alternate barriers to provide a means of meeting stringent water infiltration requirements. One type of alternate barrier being considered is an asphalt-based layer, 1.3 to 15 cm thick. Evaluations of these barriers were initiated in FY 1988, and, based on laboratory studies, two asphalt formulations were selected for further testing in small-tube lysimeters: a hot rubberized asphalt and an admixture of cationic asphalt emulsion and concrete sand containing 24 wt% residual asphalt. Eight lysimeters containing asphalt seals were installed as part of the Small Tube Lysimeter Test Facility on the Hanford Site. Two control lysimeters containing Hanford sand with a surface gravel treatment were also installed for comparison. 5 refs., 13 figs., 1 tab.

4802 (RHO-BWI-DP–039) **Suprabasalt stratigraphy within and adjacent to the reference repository location.** Bjornstad, B.N. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. 12 Oct 1983. 19p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This data-package contains six detailed stratigraphic correlations and structure cross sections of suprabasalt sediments in the area adjacent to and including the Reference Repository Location. 4 refs., 1 fig.

4803 (RHO-BWI-DP–041) **Rock mechanics data package.** Sublette, W.R. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Jan 1986. 78p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This data package provides a summary of available laboratory and in situ stress field test results from site characterization investigations by the Basalt Waste Isolation Project Modeling and Analysis Group. The objective is to furnish rock mechanics information for use by Rockwell Hanford Operations and their subcontractors in performance assessment and engineering studies. This release includes Reference Repository Location (RRL) site specific laboratory and field test data from boreholes RRL-2, RRL-6, and RRL-14 as well as previous Hanford wide data available as of April, 1985. 25 refs., 9 figs., 15 tabs.

4804 (RHO-BWI-DP–042) **Water-level data and borehole description of monitoring wells used by the Basalt Waste Isolation Project.** Swanson, L.C.; Leventhal, B.A. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Dec 1984. 195p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This data package reports water-level measurements through September 1984, for the monitoring wells used by the Basalt Waste Isolation Project. Other information presented in this package includes the borehole location, hydrogeologic units being monitored, depth intervals of monitored zones, monitoring period, monitoring frequency, and summary well hydrographs. In addition, details about borehole construction are presented for each well. 30 refs., 2 figs., 2 tabs.

4805 (RHO-BWI-DP–043) **X-ray fluorescence data from deep boreholes in the Pasco Basin.** Landon, R.D. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. 22 Feb 1984. 80p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This data package contains X-ray fluorescence analysis data for all deep boreholes in the Pasco Basin. Included are the borehole locations, the stratigraphic identification for each sample, analysis batch number, basalt chemical type, cross reference, and data usage limitations. All deep borehole analyses done prior to 9-30-83 are included. Deep boreholes included are DC-2, 3, 4, 6, 7, 8, 12, 14, 15, DDH-3, DH-4, 5, RRL-2, 6, and 14. 5 refs., 1 tab.

4806 (RHO-BWI-DP–045-Rev.1) **Water-level data collected from piezometer clusters DC-19, DC-20 and DC-22, April 1 through April 30, 1984.** Bryce, R.W.; Yeatman, R.A. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Jan 1985. 54p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This data package reports the April 1 through April 30, 1984, water-level data from the DC-19, -20 and -22 piezometers set in selected horizons at the Hanford Site. Included in the package is information concerning borehole locations, hydrogeologic units being monitored, depth intervals of monitored zones, and depth-to-water measurements. Also included are summary water-level hydrographs for each piezometer on a per site basis. 12 figs., 1 tab.

4807 (RHO-BWI-DP–048) **Water-level data collected from piezometer clusters DC-19, DC-20 and DC-22, May 1 through May 31, 1984.** Yeatman, R.A.; Bryce, R.W. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Jul 1984. 51p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI.

This data package reports the May 1 through May 31, 1984, water-level data from the DC-19, DC-20, and DC-22 piezometers set in selected horizons at the Hanford Site. Included in the package is information concerning borehole locations, hydrogeologic units being monitored, depth intervals of monitored zones, and depth-to-water

measurements. Also included are summary water-level hydrographs for each piezometer on a per site basis. 5 refs., 12 figs.

4808 (RHO-BWI-DP–049) **Depth-to-water, downhole pressure and atmospheric pressure measurements from piezometer clusters DC-19, DC-20 and DC-22, June 1 through June 30, 1984.** Bryce, R.W.; Yeatman, R.A. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Sep 1984. 295p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI.

This data package reports the June 1 through June 30, 1984, water-level data from the DC-19, DC-20 and DC-22 piezometers set in selected horizons at the Hanford Site. Included in the package is information concerning borehole locations, hydrogeologic units being monitored, depth intervals of monitored zones, depth-to-water measurements, downhole pressure and atmospheric pressure measurements. Also included are summary water-level hydrographs for each piezometer. 6 refs., 33 figs., 5 tabs.

4809 (RHO-BWI-DP–050) **Water-level, downhole pressure and atmospheric pressure measurements from piezometer clusters DC-19, DC-20 and DC-22, July 1 through July 31, 1984.** Bryce, R.W.; Yeatman, R.A. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Sep 1984. 313p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This data package reports the July 1 through July 31, 1984, water-level data from the DC-19, DC-20 and DC-22 piezometers set in selected horizons at the Hanford Site. Included in the package is information concerning borehole locations, hydrogeologic units being monitored, depth intervals of monitored zones, water-level measurements, downhole pressure and atmospheric pressure measurements. Also included are summary water-level hydrographs for each piezometer. 12 refs., 33 figs., 5 tabs.

4810 (RHO-BWI-DP–051) **Hydraulic property data from selected test zones on the Hanford Site.** Strait, S.R.; Mercer, R.B. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Nov 1984. 13p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This data package contains a summary of hydraulic properties, as determined from analysis of hydrologic test data, of selected test zones on the Hanford Site within the Vantage interbed and Grande Ronde basalt. The information within this data package includes: borehole, stratigraphic horizon, use codes, isolated interval, effective test interval, transmissivity, observed hydraulic head, and the uncertainty of the hydraulic head value. The hydraulic properties are considered preliminary and subject to change with further analysis and subsequent documentation. The observed hydraulic head values are uncorrected field-derived values. 6 refs., 1 tab.

4811 (RHO-BWI-DP–052) **Water-level, downhole pressure and atmospheric pressure measurements from piezometer clusters DC-19, DC-20 and DC-22, August 1 through August 31, 1984.** Bryce, R.W.; Yeatman, R.A. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Oct 1984. 331p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This data package reports the August 1 through August 31, 1984, water-level data from the DC-19, DC-20 and DC-22 piezometers set in selected horizons at the Hanford Site. Included in the package is information concerning borehole locations, hydrogeologic units being monitored, depth intervals of monitored zones, water-level measurements, downhole pressure and atmospheric pressure measurements. Also included are summary water-level hydrographs for each piezometer.

4812 (RHO-BWI-DP–055) **Water-level data collected from piezometer cluster sites DC-19, DC-20 and DC-22 from their completion through March 31, 1984.** Yeatman, R.A.; Bryce, R.W. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Nov 1985. 71p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI.

This data package reports water-level data collected from the DC-19, DC-20, and DC-22 piezometers set in selected horizons at the Hanford Site. Included in the package is information concerning borehole locations, hydrogeologic units being monitored zones, and water-level measurements. Also included are summary water-level hydrographs for each piezometer. 16 refs., 30 figs., 1 tab.

4813 (RHO-BWI-DP–059) **Water-level, downhole pressure and atmospheric pressure measurements from piezometer clusters DC-19, DC-20 and DC-22, December 1 through December 31, 1984.** Bryce, R.W.; Yeatman, R.A. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Mar 1985. 300p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This data package reports the December 1 through December 31, 1984, water-level data from the DC-19, DC-20, and DC-22 piezometers set in selected horizons at the Hanford Site. Included in the package is information concerning borehole locations, hydrogeologic units being monitored, depth intervals of monitored zones, water-level measurements, downhole pressure and atmospheric pressure measurements. Also included are summary water-level hydrographs for each piezometer. 17 refs., 33 figs., 3 tabs.

4814 (RHO-BWI-DP–064) **Water-level data for monitoring wells used by the Basalt Waste Isolation Project from October 1, 1984 through March 31, 1985.** Swanson, L.C.; Wilcox, S.E. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. May 1985. 160p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This data package reports water-level measurements from October 1, 1984 through March 31, 1985 for the Basalt Waste Isolation Project monitoring wells. Other information presented in this report includes, hydrographs for each borehole, monitoring devices and procedures used to take water-level measurements, borehole locations and elevations, and anthropogenic activities over the last six months that have caused water-level fluctuations. 6 refs., 2 figs., 1 tab.

4815 (RHO-BWI-ER–010) **Assessment of the rock burst potential in basalt at the Hanford Site.** Blake, W. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. 17 Dec 1984. 83p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

The phenomenon of rock bursting has been reviewed and specific case histories have been presented, along with the measures most commonly taken to minimize their occurrence and effects. A combination of high stresses and brittle rock types is necessary to initiate bursting but is not sufficient to do so unless other parameters are present (i.e. an extensive mined-out area, a high extraction ratio, and geologic structures, or discontinuities). Since none of these parameters will result from the construction of a deep underground nuclear waste repository in basalt at the Hanford Site in Southeastern Washington, rock bursting should not occur either during or after this construction. 75 refs., 35 figs., 2 tabs.

4816 (RHO-BWI-ES–015) **Task 5, Engineering study no. 6, Tunnel optimization.** Black, M.T. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. 17 May 1984. 338p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-80RL10000. Available from OSTI.

This engineering study has been prepared to examine and evaluate alternative repository layouts, rock support methods, excavation methods and drift (opening) size and shape. Development needs and performance requirements are given for those items not representing proven technology. The basis for this engineering study is a total storage requirement of 47,400 MTHM (metric tons of heavy metal). The study will be used to provide data and information for the upgraded conceptual design but the extent to which it is used is dependent on the findings and conclusions of Engineering Study No. 9. 49 refs., 62 figs., 26 tabs.

4817 (RHO-BWI-ES–016) **Task V, engineering study No. 5: Shaft optimization.** Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations; Kaiser Engineers (California)

Corp., Oakland, CA (USA). Jul 1984. 327p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-80RL10000. Available from OSTI; INIS.

This engineering study was performed primarily to determine the development testing required to design and construct repository shafts at Hanford by blind boring methods and to formulate performance requirements for such development and testing.

4818 (RHO-BWI-ES–021) **Task V engineering study No. 1 assessment of the impact on the NWRB conceptual design of increasing receipts to a total waste equivalent of 72,000 metric tons of heavy metal.** Naiknimbalkar, N.M. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Dec 1983. 84p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-80RL10000. Available from OSTI; INIS.

This engineering study has been prepared to identify and assess the nature of the impact on the NWRB design, operations plan, schedule, and cost of receiving waste equivalent to 72,000 metric tons of heavy metal (MTHN); which is an increase of 24,600 MTHM over the baseline NWRB design. 4 refs., 9 figs., 41 tabs.

4819 (RHO-BWI-PD–012) **Decision memorandum for waste emplacement concept.** Henry, K.H. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. 28 Jun 1984. 52p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

The Basalt Waste Isolation Project (BWIP) has made the following decision: The waste emplacement concept, (for spent fuel and commercial high-level waste) to be used as the preferred basis for current repository design studies, planning, and documentation is the Short Horizontal Borehole (SHB) Concept. This decision will be a basis for the repository layout studies and for BWIP planning. This decision memorandum presents in summary fashion: need for decision; basis for decision; and implementation of decision. 10 figs., 9 tabs.

4820 (RHO-BWI-PD–015) **Proposed methodology for completion of disruptive scenario analysis.** Davis, J.D. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations; Golder Associates, Inc., Bellevue, WA (USA). 1984. 105p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This report presents the methodology to complete an assessment of post-closure performance under disruption scenario conditions for a proposed repository for high-level nuclear waste at the Hanford Site, Washington State. The methodology consists of defensible techniques for identifying and screening disruption scenarios, and for then assessing the assessment. The results of the disruption scenario analysis and the nominal-case performance assessment are combined to comprehensively determine system performance for evaluation of compliance with post-closure performance criteria. 49 refs., 24 figs., 1 tab.

4821 (RHO-BWI-SA–123) **Preliminary results from the full-scale heater tests at the Near-Surface Test Facility.** Gregory, E.C.; Kim, K. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. [1981]. 7p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. (CONF-810624–14: 22. US symposium on rock mechanics, Cambridge, MA (USA), 29 Jun - 2 jul 1981). Available from OSTI; INIS.

The Basalt Waste Isolation Project (BWIP), as part of the National Waste Terminal Storage (NWTS) program, US Department of Energy (DOE), has been conducting the Full-Scale Heater Tests to enhance the understanding of the behavior of a rock mass subjected to the thermal loading expected on emplacement of radioactive nuclear waste deep underground. The Full-Scale Heater Tests were initiated on July 1, 1980 and are scheduled to continue until June 1982. These tests are being conducted at the Near-Surface Test Facility (NSTF) which was designed as a multipurpose field test facility to investigate the feasibility of constructing a permanent waste repository in the Columbia River basalt. The NSTF is located in Gable Mountain on the Hanford Site in south-central Washington. This location was chosen because of its easy access to the Pomona basalt which has similar characteristics to the Umtanum flow found at approximately 1000 meters depth and considered a potential candidate for repository siting. Comprehensive field investigations are being carried out at the NSTF in the areas of site characterization and the determination of rock mass properties. These studies were designed to provide information required for development of predictive modeling techniques and to form a data base necessary for repository design and construction. 11 refs., 12 figs.

4822 (RHO-BWI-SD–005-Vol.2) **Conceptual system design description: Nuclear Waste Repository in Basalt, Project B-301: Volume 2.** Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations; Kaiser Engineers (California) Corp., Oakland, CA (USA). Apr 1983. 79p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-80RL10000. Available from OSTI; INIS.

This document contains the drawings which support the description of the Conceptual System Design Description of the Nuclear Waste Repository in Basalt, as executed by the joint venture of Raymond Kaiser Engineers Inc./Parsons Brinckerhoff Quade & Douglas, Inc., under technical direction of Rockwell Hanford Operations. The document incorporates peer review comments and is dated May 1983. Volume 1 of the document contains the text of the conceptual system design description and Volume 3 is the summary report of the accompanying cost estimate. 73 figs.

4823 (RHO-BWI-TA–006) **Archaeological inventory of the Basalt Waste Isolation Project Hanford Reservation, Washington.** McCarthy, M.M. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Nov 1981. 39p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This archaeological inventory survey assesses the potential impacts of the Basalt Waste Isolation Project (BWIP) upon archaeological and historic sites. The intensive survey effort had two aspects: (1) survey of the A-H Site, the Reference Repository for long-term nuclear waste storage; and (2) evaluation of impacts upon archaeological sites at 40 borehole drilling locations on the Hanford Reservation in south central Washington. The report concludes that none of the described BWIP undertakings will have an effect upon significant cultural resources. The report does recommend, however, that survey work and construction monitoring should be routinely carried out to avoid potential adverse effects. 12 refs., 18 figs., 1 tab.

4824 (RHO-BWI-TA–007-Rev.1) **Archaeological survey and monitoring of initial excavations within the basalt waste isolation project reference repository location and associated drill borehole site locations: Revision 1.** McCarthy, M.M. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. 19 Jun 1984. 14p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI.

This letter report concerns cultural resources studies undertaken in November 1982 for the exploratory shaft starter hole and surface facilities for the Basalt Waste Isolation Project (BWIP). These studies were carried out under the provisions of the National Environmental Policy Act, the amended National Historic Preservation Act, and the Archaeological Resources Act. This report concludes that neither cultural nor palentological resources are being affected by the BWIP during the present phase of construction work and test drilling. 4 refs., 10 figs.

4825 (RHO-BWI-TA–013) **Preliminary uncertainty analysis of pre-waste-emplacement groundwater travel times for a proposed repository in basalt.** Clifton, P.M.; Arnett, R.C. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. 1984. 38p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

Preliminary uncertainty analyses of pre-waste-emplacement groundwater travel times are presented for a potential high-level nuclear waste repository in the deep basalts beneath the Hanford Site, Washington State. The uncertainty analyses are carried out by means of a Monte Carlo technique, which requires the uncertain inputs to be described as either random variables or spatial stochastic processes. Pre-waste-emplacement groundwater travel times are modeled in a continuous, flat-lying basalt flow top that is assumed to overlie the repository horizon. Two-dimensional, steady

state groundwater flow is assumed, and transmissivity, effective thickness, and regional hydraulic gradient are considered as uncertain inputs. Groundwater travel time distributions corresponding to three groundwater models are presented and compared. Limitations of these preliminary simulation results are discussed in detail.

4826 (RHO-BWI-TD–012) **Chemical analysis of drilling fluid and drilling fluid additives used in a cleanup test on borehole DC-14.** Halko, D.J. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. 23 Oct 1984. 27p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

The drilling fluid and fluid additives used in a cleanup test conducted in borehole DC-14 have been analyzed for cations, anions, and carbon. The major constituents (>1%) of the water soluble additives are sodium, chromium, sulfate and inorganic and organic carbon. From the composition of the individual fluid additives, the composition of the fluid can be rationalized. It was also experimentally demonstrated that one of the water soluble additives (chrome lignosulfonate) is partitioned between the aqueous and solid phases of the fluid. These results will be useful in evaluating the impact that drilling fluid contamination may have on groundwater chemistry. Reanalysis of aged (1 yr) groundwater samples shows that there are no significant changes in concentration of cations and anions over this period of time. Therefore, the results obtained for aged cleanup samples No. 1 and No. 2 reported here can be used to complete the data set for this test. 7 refs., 4 figs., 8 tabs.

4827 (RHO-BWI-TI–023) **Analysis of thermal properties of basalt from heater Test No. 2 experiment.** Huyakorn, P. (GeoTrans, Inc., Reston, VA (USA)); Williams, J.R.; Thomas, S. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. 4 Oct 1981. 181p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

Rockwell Hanford Operations is conducting a series of full-scale in situ tests at the Near Surface Test Facility (NSTF) near Richland, Washington as an integral part of the Basalt Waste isolation project. An objective of the Phase I tests, which include Main Heater Test No. 2, is to provide data for determination the material properties necessary for predicting the response of a repository system at depth. During the first 90 days Heater Test No. 2 represents the near-field response of a high-level waste canister which generates 1 kW of heat energy. The analysis of the thermal response of basalt from data collected during this initial heating period is described in this report. Values of thermal conductivity and heat capacity for basalt are determined using three methods referred to as type curve matching, Jacob's straight line method, and the Gauss-Newton parameter optimization method. Results indicate that the type curve and the Gauss-Newton methods give values which correspond relatively closely to those measured in the laboratory.

4828 (RHO-BWI-TI–089) **Preliminary results of hydrologic testing of the Umtanum Basalt Fracture Zone at borehole RRL-2 (3,781 to 3,827 ft).** Strait, S.R.; Spane, F.A. Jr. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Feb 1983. 37p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This report presents preliminary results and description of hydrologic test activities for the Umtanum Basalt Fracture Zone at Borehole RRL-2, within the test interval 3,781 to 3,827 feet. Hydrologic tests conducted include two short-term, constant discharge pumping tests and two slug tests. Preliminary results indicate an observed hydraulic head for the test interval of 406.7 feet above mean sea level. Transmissivity values determined from hydrologic tests performed range between 205 and 881 ft^2/day. The best estimate of equivalent hydraulic conductivity, based on an effective test thickness of 6 feet, is 147 ft/day. 8 refs., 6 figs., 3 tabs.

4829 (RHO-BWI-TI–095) **Preliminary results of hydrologic testing the composite middle sentinel bluffs basalt flow bottom at Borehole RRL-2 (3,247–3,344 feet).** Strait, S.R.; Spane, F.A. Jr. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Nov 1982. 36p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This report presents preliminary results and description of hydrologic test activities for the composite Middle Sentinel Bluffs basalt flow bottom (3,247-3,344 feet) at Borehole RRL-2. Hydrologic tests conducted include one constant discharge air-lift and two slug tests. Preliminary results indicate an observed hydraulic head for the test interval of 405.5 feet above mean sea level. Transmissivity values determined from hydrologic tests performed range between 203 and 847 ft^2/day, with an assigned best estimate of 770 ft^2 day. The best estimate of equivalent hydraulic conductivity, based on an effective test thickness of 77.5 feet, is 9.9 ft/day.

4830 (RHO-BWI-TI–102) **Preliminary results of hydrologic testing the Middle Sentinel Bluffs flow-top at borehole RRL-2 (2981 - 3020 feet).** Strait, S.R.; Spane, F.A. Jr. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Jan 1983. 39p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This report presents preliminary results and description of hydrologic testing activities for the Middle Sentinel Bluffs flow top (2,981-3,020 feet) at Borehole RRL-2. Hydrologic tests conducted include four over-pressure pulse, one constant head injection, and one slug injection test. Preliminary results indicate an observed hydraulic head for the test interval of 398.8 feet above mean sea level. Transmissivity values determined from hydrologic tests performed range between 9.3×10^{-3} to 6.2×10^{-2} ft^2/day, with an assigned best estimate of 4.2×10^{-2} ft^2/day. The best estimate of equivalent hydraulic conductivity, based on an effective test thickness of 19 feet, is 2.2×10^{-3} ft/day. 8 refs., 10 figs., 4 tabs.

4831 (RHO-BWI-TI–105) **Preliminary results of hydrologic testing: The composite Umtanum basalt flow top at borehole RRL-2 (3,568 - 3,781 feet).** Strait, S.R.; Spane, F.A. Jr. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Nov 1982. 45p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This report presents preliminary results and description of hydrologic test activities for the composite Umtanum basalt flow top (3,568–3,781 feet) at Borehole RRL-2. Hydrologic tests conducted include two constant discharge air-lift and four slug tests. Preliminary results indicate an observed hydraulic head for the test interval of 405.7 feet above mean sea level. Transmissivity values determined from hydrologic tests performed, range between 244 to 481 ft^2/day, with an assigned best estimate of 480 ft^2/day. The best estimate of equivalent hydraulic conductivity, based on an effective test thickness of 157 feet, is 3.1 ft/day. 7 refs., 9 figs., 3 tabs.

4832 (RHO-BWI-TI–177) **Reprocessing and interpretation, seismic reflection data: Hanford Site, Pasco Basin, south central Washington.** Berkman, E. (Emerald Exploration Consultants, Inc., Austin, TX (USA)). Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations; Emerald Exploration Consultants, Inc., Austin, TX (USA). 16 Dec 1983. 733p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

The purpose of this project was to reprocess, evaluate, and reinterpret 14 line miles of seismic reflection data acquired at the Hanford Site. Regional and area-specific geology has been reviewed, the data acquisition parameters as they relate to the limitations inherent in the data have been discussed, and the reprocessing procedures have been described in detail along with an evaluation of the original processing. After initial testing, the focus of the reprocessing was placed on resolution of the geologic horizons at and near the top of the basalt. The reprocessed seismic data shows significant improvement over the original processing. The improvement is the result of the integrated processing and interpretation approach where each processing step has been tested in sequence and the intermediate results examined carefully in accordance with the project goals. The interpretation procedure placed strong reliance upon synthetic seismograms and models calculated based upon the physical parameters of the subsurface materials, and upon associated geophysical (reflection, gravity, magnetic) data. The final interpretation of the seismic data is in agreement with the

structural contour maps based primarily on borehole information. The seismic interpretation has added important detail concerning areas which should be considered for further study. 60 figs., 1 tab.

4833 (RHO-BWI-TI-190) **The effect of basalt on the release of ^{99}Tc, ^{237}Np, and ^{239}Pu from borosilicate glass under hydrothermal conditions.** Coles, D.G. (Pacific Northwest Lab., Richland, WA (USA)). Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations; Pacific Northwest Lab., Richland, WA (USA). Dec 1983. 126p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This report describes the results from the initial four hydrothermal waste-package tests, both tracer and fully radioactive waste forms. The initial four tests were performed in the tracer-testing facility and included both a ^{99}Tc-doped borosilicate glass waste form and a ^{237}Np and ^{239}Pu-doped glass waste form. Both waste forms had the same composition except for differing radioactive dopants. The purpose of these tests was two fold. They provided the Team with experience in the hydrothermal testing of radioactive waste forms, including the analysis of the fluid and solid samples. The tests also provided important baseline data on Tc, Np, and Pu behavior under the hydrothermal conditions of a waste repository located in basalt for comparison to later tracer and fully radioactive tests.

4834 (RHO-BWI-TI-202) **Evaluation of alternative waste package concepts for spent fuel.** Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations; Westinghouse Electric Corp., Madison, PA (USA). Waste Technology Services Div. Sep 1984. 278p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. (WTSD-TME-025). Available from OSTI; INIS.

This document report the results of an engineering study performed by Westinghouse Waste Technology Services Division for Rockwell under subcontract CPFF-880. The study consisted of evaluating 23 alternative waste package concepts. A trade study format was used for the evaluation, in which technical experts performed concept ratings through the use of utility functions, which provided a consistent method of comparing quantitative and qualitative evaluations. The resulting ratings were combined to obtain overall figures-of-merit, using weighting factors derived from a survey of both technical and non-technical individuals. 34 refs.

4835 (RHO-BWI-TI-203) **Hydraulic conductivity and moisture/density relationships of candidate packing material.** Carlson, R.A. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Apr 1985. 46p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

Laboratory experiments have been completed to provide moisture/density relationship and hydraulic conductivity physical property data for packing materials. Both moisture/density relationship and hydraulic conductivity tests were performed using packing materials consisting of bentonite clay and crushed basalt rock. Moisture/density relationship tests were performed on 20:80, 25:75, 50:50, 75:25, and 100:0 (wt.%) bentonite/basalt samples using the modified protor test. A set of moisture content versus dry density curves were generated. A typical trend of higher achievable dry density at higher basalt content was indicated due to the difference in specific gravity of basalt and bentonite. Hydraulic conductivity tests were run on 25:75 (wt.%) bentonite/basalt samples over a density range of 1.45 to 2.03 g/cm^3. Test results indicate a decrease of hydraulic conductivity as a function of both temperature and hydraulic gradient. The data gathered are applicable to both Engineered Barriers and Repository Seals Development. 9 refs., 22 figs., 11 tabs.

4836 (RHO-BWI-TI-226-Rev.1) **Piezometer completion report for borehole cluster sites DC-19, DC-20, and DC-22.** Jackson, R.L.; Diediker, L.D.; Ledgerwood, R.K.; Veatch, M.D. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Jul 1984. 379p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This report describes the design and installation of multi-level piezometers at borehole cluster sites DC-19, DC-20 and DC-22. The network of borehole cluster sites will provide facilities for multi-level water-level monitoring across the RRL for piezometer baseline monitoring and for large-scale hydraulic stress testing. These groundwater-monitoring facilities were installed between August 1983 and March 1984. Three series of piezometer nests (A-, C- and D-series) were installed in nine hydrogeologic units (monitoring horizons) within the Columbia River Basalt Group at each borehole cluster site. In addition to the piezometer facilities, a B-series pumping well was installed at borehole cluster sites DC-20 and DC-22. The A-series piezometer nest monitors the basal Ringold sediments and the Rattlesnake Ridge interbed. The C-series piezometer nests monitors the six deepest horizons, which are in increasing depth, the Priest Rapids interflow, Sentinel Gap flow top, Ginkgo flow top, Rocky Coulee flow top, Cohassett flow top and Umtanum flow top. The D-series piezometer monitors the Mabton interbed. The B-series pumping well was completed in the Priest Rapids interflow. 21 refs., 6 figs., 6 tabs.

4837 (RHO-BWI-TI-226-Rev.1) **Piezometer completion report for borehold cluster sites DC-19, DC-20 and DC-22: Revision 1.** Jackson, R.L.; Diediker, L.D.; Ledgerwood, R.K.; Veatch, M.D. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Jul 1984. 410p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This report describes the design and installation of multi-level piezometers at borehole cluster sites DC-19, DC-20 and DC-22. The network of borehole cluster sites will provide facilities for multi-level water-level monitoring across the RRL for piezometer baseline monitoring and for large-scale hydraulic stress testing. These groundwater-monitoring facilities were installed between August 1983 and March 1984. Three series of piezometer nests (A-, C- and D-series) were installed in nine hydrogeologic units (monitoring horizons) within the Columbia River Basalt Group at each borehole cluster site. In addition to the piezometer facilities, a B-series pumping well was installed at borehole cluster sites DC-20 and DC-22. The A-series piezometer nest monitors the basal Ringold sediments and the Rattlesnake Ridge interbed. The C-series piezometer nests monitors the six deepest horizons, which are in increasing depth, the Priest Rapids interflow. 21 refs., 6 figs., 14 tabs.

4838 (RHO-BWI-TI-227) **McGee Well report.** Wood, T.J. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations); Mack, G.S.; Pidcoe, W.W.; Cline, C.S. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Oct 1984. 79p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

The McGee Well is part of the Basalt Waste Isolation Project's subsurface site selection and characterization activities. Information from the McGee Well support site hydrologic characterization and repository design. This report summarized the drilling coring operations, geologic logging, geophysical logging and hydrological testing, between June 1982 and October 1983. 22 refs., 11 figs., 10 tabs.

4839 (RHO-BWI-TI-228) **Hydrothermal interaction of Columbia Plateau basalt from the umtanum flow the coexisting groundwater.** Moore, E.L. (Temple Univ., Philadelphia, PA (USA). Dept. of Geology); Ulmer, G.C.; Grandstaff, D.E. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations; Temple Univ., Philadelphia, PA (USA). Dept. of Geology. 7 Dec 1984. 58p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

A series of experiments have been performed in which tholeiitic basalt from the Umtanum flow of the Columbia River Plateau was reacted with the synthetic equivalent of groundwater with which it is in contact at a pressure of 300 bars, temperature of 100°, 200°, and 300°C, and water: rock mass ratios between 5 and 50. Reaction products formed included: silica, illite, scapolite, wairakite, heulandite, potassium feldspar, and smectite. The alteration mineral assemblage formed during the experiments are similar to those predicted for equilibrium with geothermal waters in a tholeiitic system. Solution pH decreased relative to that of the initial solution. The final calculated high-temperature pH values were near 7.6 at 300°C, 7.5 at 200°C, and 7.2 at 100°C. The pH decrease is much less than that of basalt/sea water experiments. The pH decrease may be

due to incorporation of sodium into secondary products. Solution composition was modified. Silica, aluminum, potassium, and sulfide increased, whereas sodium decreased. The oxidation state of the solution became reduced during the experiment, approaching the hematite-magnetite-pyrite invariant point at 300°C. The solution composition from the experiments compare favorably with the compositions of some Icelandic geothermal fluids. 33 refs., 10 figs., 7 tabs.

4840 (RHO-BWI-TI-229) **A final report on hydrothermal testing of ^{99}Tc-doped glass waste form and waste package components.** Schramke, J.A. (Pacific Northwest Lab., Richland, WA (USA)); Thomas, L.E.; McKinley, S.G.; Simonson, S.A.; Coles, D.G. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations; Pacific Northwest Lab., Richland, WA (USA); Westinghouse Hanford Co., Richland, WA (USA). Jul 1984. 171p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This document reports the results of four experiments using borosilicate glass doped with the key radionuclide ^{99}Technicium. The experiments were performed in Dickson rocking autoclaves at 200°C, 30MPa pressure for 3 months. Starting materials consisted of the doped glass (+ undoped borosilicate glass)· in GR-3 groundwater. To simulate various possible interactions among waste package components, the glass-groundwater starting materials were run either alone, or combined with RUE-basalt, or cast steel or both. The Dickson autocalve allowed periodic sampling of the fluid, through which concentrations of dissolved species were monitored. In the glass-only experiment, Tc concentration increased until reaching an apparent steady-state concentration of 55 mg/1 after 1000 hours. In runs with basalt, steel or both, this concentration reached steady-state at three or more orders of magnitude below that. 29 refs., 23 figs., 8 tabs.

4841 (RHO-BWI-TI-230) **Preliminary sensitivity analyses of corrosion models for BWIP [Basalt Waste Isolation Project] container materials.** Anantatmula, R.P. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. 30 Apr 1984. 22p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

A preliminary sensitivity analysis was performed for the corrosion models developed for Basalt Waste Isolation Project container materials. The models describe corrosion behavior of the candidate container materials (low carbon steel and Fe9Cr1Mo), in various environments that are expected in the vicinity of the waste package, by separate equations. The present sensitivity analysis yields an uncertainty in total uniform corrosion on the basis of assumed uncertainties in the parameters comprising the corrosion equations. Based on the sample scenario and the preliminary corrosion models, the uncertainty in total uniform corrosion of low carbon steel and Fe9Cr1Mo for the 1000 yr containment period are 20% and 15%, respectively. For containment periods $\geq$ 1000 yr, the uncertainty in corrosion during the post-closure aqueous periods controls the uncertainty in total uniform corrosion for both low carbon steel and Fe9Cr1Mo. The key parameters controlling the corrosion behavior of candidate container materials are temperature, radiation, groundwater species, etc. Tests are planned in the Basalt Waste Isolation Project containment materials test program to determine in detail the sensitivity of corrosion to these parameters. We also plan to expand the sensitivity analysis to include sensitivity coefficients and other parameters in future studies. 6 refs., 3 figs., 9 tabs.

4842 (RHO-BWI-TI-232) **An analytical one-dimensional model for predicting waste package performance.** Relyea, J.F.; Wood, M.I. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. [1984]. 49p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

A method for allocating waste package performance requirements among waste package components with regard to radionuclide isolation has been developed. Modification or change in this approach can be expected as the understanding of radionuclide behavior in the waste package improves. Thus, the performance requirements derived in this document are preliminary and subject to change. However, this kind of analysis is a useful starting point. It has also proved useful for identifying a small group of radionuclides which should be emphasized in a laboratory experimental program designed to characterize the behavior of specific radionuclides in the waste package environment. A simple one-dimensional, two media transport model has been derived and used to calculate radionuclide transport from the waste form-packing material interface of the waste package into the host rock. Cumulative release over 10,000 years, maximum yearly releases and release rates at the packing material-host rock interface were evaluated on a radionuclide-by radionuclide basis. The major parameters controlling radionuclide release were found to be: radionuclide solubility, porosity of the rock, isotopic ratio of the radionuclide and surface area of the waste form-packing material interface. 15 refs., 2 figs., 16 tabs.

4843 (RHO-BWI-TI-233) **Interpretation of magnetotelluric data: Pasco Basin, south central Washington.** Orange, A. (Emerald Exploration Consultants, Inc., Austin, TX (USA)); Berkman, E. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations; Emerald Exploration Consultants, Inc., Austin, TX (USA). 1 Jul 1985. 285p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

The purpose of this project was to review, evaluate, and interpret magnetotelluric (MT) data collected in support of the Basalt Waste Isolation Project. The integrated interpretation presented is related to regional and site-specific geology and associated borehole, gravity, and magnetic data. The MT interpretation procedure placed strong reliance on computer models based upon the inferred physical parameters of the subsurface materials and their anticipated variability. Much of the MT data is of poor quality by current standards; however, significant qualitative observations can be made. The quantification of these observations, including the procedures and assumption utilized, are discussed in detail. Problems related to ambiguities inherent in the MT method are discussed as related to the Pasco Basin MT data. 117 refs., 77 figs., 3 tabs.

4844 (RHO-BWI-TI-234) **Porthole drilling demonstration.** McLellan, G.W. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. 1 Jul 1984. 5p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This report presents data collected in the initial phase of operation and equipment evaluation of the porthole drilling assembly.

4845 (RHO-BWI-TI-235) **Corrosion evaluation of candidate iron-base nuclear waste package alloys in Grande Ronde basalt groundwater.** Westerman, R.E. (Battelle Pacific Northwest Lab., Richland, WA (USA)). Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations; Pacific Northwest Lab., Richland, WA (USA). Feb 1984. 15p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

The corrosion behavior of several iron-base alloys has been determined in synthetic oxic Hanford Grande Ronde basalt groundwater at temperatures of 150° and 250° in the presence of no radiation and at 250°C under gamma irradiation dose rate of 3×10^5 rad/hr. The objective of the studies is the selection of one or more materials for long-lived waste package containers that will maintain their integrity for time periods up to 1000 years in a basalt-site repository. The corrosion rates of the iron-base alloys are increased by the presence of 3×10^5 rad/hr irradiation under the 250° test conditions, and the corrosion rates of the materials increased at 150°C compared to 250°C under unirradiated conditions. Cast low-alloy steel containing a small amount (2-1/2%) of chromium demonstrated the best resistance to corrosion. All ferrous materials showed some degree of non-uniform attack by the end of the tests (20 months maximum). 5 refs., 3 figs., 5 tabs.

4846 (RHO-BWI-TI-238) **Hydrothermal reactions in the system basalt/simulated spent fuel/groundwater at 100°C and 30 MPa pressure: Final milestone report.** McKeon, G.L. (Temple Univ., Philadelphia, PA (USA)); Ulmer, G.C.; Grandstaff, D.E.; Kimberley, M.M. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations; Temple Univ., Philadelphia, PA (USA). Apr 1984. 54p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This report presents results of an experiment in which synthetic Grande Ronde groundwater was reacted with basalt from the Umtanum flow of the Columbia Plateau and simulated spent fuel at a temperature of 100°C, pressure of 30 MPa, and a basalt: simulated spent fuel:groundwater mass ratio of 1:1:20 for a duration of ca. 7000 hours. Reaction products that formed during the 100°C experiment included: illite, barite, coffinite, uranophane, and crytolite. The solution composition was modified during the experiment. Concentrations of uranium, thorium, samarium, cerium, rhenium, yttrium, and palladium were low during the experiment. Molybdenum, cesium, and iodide were present in higher concentrations and thus, were fairly mobile. The calculated steady-state high-temperature pH was 7.6. This value is very near the calculated pH value in the basalt/water system at 100°C and suggests that the addition of simulated spent fuel does not greatly alter the calculated steady-state high-temperature pH. The redox state is altered by the presence of simulated spent fuel, however. The oxygen fugacity at 100°C, as indicated by equilibrium of UO_2 and $USiO_4$ with the dissolved uranium species concentration, is 10^{-36} and 10^{-35}, respectively. These values are more oxidizing than those predicted from basalt/water experiments and suggests that at a 1:1 basalt:simulated spent fuel mass ratio the simulated spent fuel controls the redox state of the system. 23 refs., 10 figs., 6 tabs.

4847 (RHO-BWI-TI-247) **Summary of geotechnical information in the Rattlesnake Mountain area.** Fecht, K.R.; Gephart, R.E.; Graham, D.L.; Reidel, S.P.; Rohay, A.C. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Aug 1984. 108p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This document summarizes the available geotechnical information from the Rattlesnake Mountain area, located along the southwestern boundary of the Hanford Site. The discussion emphasizes the geohydrologic environment of the anticlinal ridges in the vicinity of Rattlesnake Mountain. Included in the document is information concerning the stratigraphy, structure, geomorphology, seismology, climatology, and hydrology, as well as the resource potential of the Rattlesnake Mountain area. 77 refs., 23 figs., 11 tabs.

4848 (RHO-BWI-TI-249) **Preliminary reliability analysis of container lifetime.** Anantatmula, R.P. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Sep 1984. 14p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

A preliminary reliability analysis of container lifetime was performed on the basis of the Basalt Waste Isolation Project (BWIP) container corrosion models. The preliminary analysis was conducted using Monte Carlo simulations of the input parameters. Two distributions were assumed for the input variables, viz., normal and uniform distribution. Cumulative probabilities to achieve specific container lifetimes were calculated from the container lifetime data. The results indicated that the reference low-carbon steel waste containers may not fail prior to 1000-year containment time regardless of the choice of the expected scenario and the selection of the distribution type for the input parameters. Therefore, it is concluded that the low-carbon steel containers are very likely to meet the Nuclear Regulatory Commission (NRC) requirements.

4849 (RHO-BWI-TI-253) **A report on the status of hydrothermal testing of fully radioactive waste forms and basalt repository waste package components.** Schramke, J.A.; Simonson, S.A.; Coles, D.G. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations; Pacific Northwest Lab., Richland, WA (USA). Sep 1984. 66p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

Initial experiments to investigate the hydrothermal behavior to basalt repository constitutents including fully radioactive waste forms have been terminated. Solutions from these three experiments have been analyzed to gather data on the concentrations of radionuclides carried in solution as a function of time through the duration of each run. Two runs contained ATM-6 glass with groundwater; one of these with basalt, one without. Turkey Point spent fuel and groundwater comprised the third experiment. In the glass experiments, which allow comparison to demonstrate the effect of basalt, several trends were noted. Dissolved silica was lower with basalt than without; pH increased slightly in the presence of basalt; concentrations in the water of $^{99}T_c$, $^{75}_{Se}$, ^{137}Cs were less with basalt than without, actinide concentration in water was lower than the calculated value. The latter two imply that these radionuclides were either adsorbed or precipitated in secondary phases. The experiment using spent fuel also demonstrates that radionuclide concentrations in solution are much less than calculated by the amount of the waste form dissolved. Again this implies that radionuclides released from the waste form are removed from the water and immobilized.

4850 (RHO-BWI-TI-254) **Effective porosities of basalt: A technical basis for values and probability distributions used in preliminary performance assessments.** Loo, W.W. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations); Arnett, R.C.; Leonhart, L.S.; Luttrell, S.P.; Wang, I-Sen; McSpadden, W.R. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Nov 1984. 67p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

The Basalt Waste Isolation Project in its role of evaluating the feasibility of siting a high-level nuclear waste repository in the deep basalts of the Columbia Plateau is gathering information on basalt parameters that define waste isolation capability. Effective porosity is an important parameter in fluid transport analysis on repository performance assessment. This report presents and discusses the technical basis for values and probability distributions of effective porosity for the candidate site in basalts of the Hanford Site in Washington State. The appropriateness of different types of probability distributions of values of effective porosity for the major basalt hydrogeologic units (i.e., flow tops and flow interiors) of candidate flows are considered with respect to their applicability in performance assessment models. 36 refs., 23 figs., 9 tabs.

4851 (RHO-BWI-TI-256) **Groundwater travel time uncertainty analysis: Sensitivity of results to model geometry, and correlations and cross correlations among input parameters.** Clifton, P.M. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Dec 1984. 69p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

The deep basalt formations beneath the Hanford Site are being investigated for the Department of Energy (DOE) to assess their suitability as a host medium for a high level nuclear waste repository. Predicted performance of the proposed repository is an important part of the investigation. One of the performance measures being used to gauge the suitability of the host medium is pre-waste-emplacement groundwater travel times to the accessible environment. Many deterministic analyses of groundwater travel times have been completed by Rockwell and other independent organizations. Recently, Rockwell has completed a preliminary stochastic analysis of groundwater travel times. This document presents analyses that show the sensitivity of the results from the previous stochastic travel time study to: (1) scale of representation of model parameters, (2) size of the model domain, (3) correlation range of log-transmissivity, and (4) cross-correlation between transmissivity and effective thickness. 40 refs., 29 figs., 6 tabs.

4852 (RHO-BWI-TI-257) **Icelandic basaltic geothermal field: A natural analog for nuclear waste isolation in basalt.** Ulmer, G.C. (Temple Univ., Philadelphia, PA (USA). Dept. of Geology); Grandstaff, D.E. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations; Temple Univ., Philadelphia, PA (USA). Dept. of Geology. 21 Nov 1984. 41p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

Analog studies of Icelandic geothermal fields have shown that the design of nuclear waste repositories in basalt can benefit by comparison to the data base already available from the development of these geothermal fields. A high degree of similarity exists between these two systems: their petrology, groundwater geochemistry, mineral solubilities, hydrologic parameters, temperature ranges, water-rock redox equilibria, hydrothermal pH values, and secondary mineralogies all show considerable overlap in the range of values. The experimentally-simulated hydrothermal studies of the basaltic nuclear waste repository rocks have, at this time, produced a data

base that receives a strong confirmation from the Icelandic analog. Furthermore, the Icelandic analog should eventually be employed to extrapolate into higher and lower temperatures, into longer time-base chemical comparisons, and into more realistic mineral deposition studies, than have been possible in the laboratory evaluations of the nuclear waste repository designs. This eventual use of the Icelandic analog will require cooperative work with the Icelandic Geological Survey. 46 refs., 4 figs., 2 tabs.

4853 (RHO-BWI-TI-258) **An analytic solution for one-dimensional diffusion of radionuclides from a waste package.** Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. 13 Mar 1985. 20p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This work implements an analytical solution for diffusion of radionuclides from a cylindrical waste form through the packing material into the surrounding host rock. Recent interest in predicting the performance of a proposed geological repository for nuclear waste has led to the development of several computer programs to predict the performance of such a repository for the next several millenia. These numerical codes are generally designed to accommodate a broad spectrum of geometrical configurations and repository conditions in order to accurately predict the behavior of the radionuclides in the repository environment. Confidence in such general purpose codes is gained by verifying the numerical modeling and the software through comparison of the numerical predictions generated by these computer codes with analytical solutions to reasonably complex problems. The analysis discussed herein implements the analytic solution, proposed by J.C. Jaeger in 1941 for radial diffusion through two concentric circular cylinders. Jaeger's solution was applied to the problem of diffusional mass transfer from a long cylindrical waste form and subsequently into the surrounding geological formation. Analytic predictions of fractional release rates, including the effects of sorption, were generated. 6 refs., 2 figs., 2 tabs.

4854 (RHO-BWI-TI-262) **Evaluation of technology for detection of anomalies during repository excavation at the BWIP [Basalt Waste Isolation Project] site: Report on Subtask 3F--Excavation instrument development of Lawrence Berkeley Laboratories Interagency Assistance to the Basalt Waste Isolation Project.** Myer, L.R. (Lawrence Berkeley Lab., CA (USA)); Major, E.L. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations; Lawrence Berkeley Lab., CA (USA). Aug 1984. 48p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

The report evaluates the methods and instrumentation technology which may be needed to detect geologic features representing possible hazards during the construction of a nuclear waste repository in basalt at Hanford. The types of anomalous features and their characteristics are first reviewed and their potential hazards identified. The features of greatest concern are judged to be flow top and bottom thickness irregularities, faults and tectonic breccias, and local jointing irregularities. The capabilities of available methods of anomaly detection ahead of construction are evaluated with respect to the Hanford site conditions. Direct (e.g. borehole drilling) and indirect (geophysical) methods are considered. Some of the more promising geophysical methods including seismic, radar and resistivity are examined in more detail. The manner in which both direct and indirect detection methods could be applied during construction of a repository is reviewed. 18 refs., 11 figs., 3 tabs.

4855 (RHO-BWI-TI-263) **Chemical interpretation of waste package water interactions.** Strachan, D.M. Pacific Northwest Lab., Richland, WA (USA). Sep 1984. 17p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

Many experiments have been performed by BWIP to determine the interaction of water at various temperatures with the different barrier components of the waste package and the host rock. These experiments have been carried out for periods up to about one year. These times are, however, short relative to the time that the waste package is expected to function. Although many of these experiments result in concentrtions that appear to be time invariant, the persistence of unstable initial phases and the presence of metastable alteration phases dictate that these concentrations are not the result of true equilibrium. Despite these limitations, attempts have been made to use chemical equilibria to calculate the phases that might be present after long storage times and the resultant solution composition. In the effort described here, the geochemical code PHREEQE (Parkhurst, Thorstenson, and Plummer 1980) has been used in such an attempt. These reactions may also be useful in describing more fully the results from interaction tests between water and waste package components. 8 refs., 4 figs., 1 tab.

4856 (RHO-BWI-TI-265) **Stratigraphy and hydrocarbon potential of the Northwestern Columbia Basin based on recent drilling activities.** Campbell, N.P. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. 13 Sep 1985. 54p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

The drilling of four deep wells by Shell Oil Company in the Columbia Basin has provided the first direct information about the nature and hydrocarbon potential of the rocks underlying the Columbia River basalt. Rocks encountered by sub-basalt drilling include Tertiary volcaniclastics and fluvial sedimentary rocks plus minor marine and igneous rocks. The sedimentary units can be correlated with rocks occurring along the basalt margin. The well data confirms the southward extent of the Naneum-Hog Ranch cross-structure. This structure appears to control the kind and distribution of sedimentary rocks underlying the Columbia River basalt. Results of exploration to date indicate little or nor oil and only noncommercial deposits of gas. The source of the hydrocarbons is thought to be derived from coal beds of Tertiary age. Since oil and gas exploration in the Columbia Basin is continuing, this report will be updated when new well date becomes available. Data from the Shell Oil company well 1-9 BN Saddle Mountains well are expected to be released in March 1986. 12 refs., 10 figs., 5 tabs.

4857 (RHO-BWI-TI-276) **Photographic comparison of the pre-test and post-test heater hole wall condition in the full scale heater tests.** Kasza, G.L. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. 29 Oct 1985. 45p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This report presents the results of an investigation of the change in condition of the primary heater holes after completion of the Full-Scale Heater Tests in Basalt. The two Full-Scale Heater Tests consisted of operating waste canister size electric heaters in vertical boreholes within the Near-Surface Test Facility to study the thermomechanical response of a basalt rock mass under thermal loading. Full-scale Heater Test 1 simulated room-scale loading conditions while Full-Scale heater Test 2 created simulated overload conditions on a single canister hole. Photographs of the walls of the heater holes taken before the tests were compared with equivalent photographs taken after the tests in an attempt to document any changes in the heater hole wall condition. This effort was intended to satisfy part of the Heater Test Post-Test Characterization Plan. Sketch maps were made of the heater hole walls and any recognized changes were documented. 8 refs., 12 figs., 3 tabs.

4858 (RHO-BWI-TI-303) **Groundwater travel time analysis for the reference repository location at the Hanford Site.** Clifton, P.M. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Jan 1986. 51p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

Pre-waste-emplacement groundwater travel times are being used by the US Department of Energy (DOE) as one measure for ultimately selecting a suitable site for a high-level nuclear waste repository from candidate sites. In the interim, this measure is being used to select sites for characterization studies. This document presents and discusses the methods and results of groundwater travel time analyses in the deep basalt sequence beneath the Hanford Site, which is being considered as a possible site for a repository. These results are suitable for evaluating the site with the DOE travel time criteria. All analyses are conducted in a stochastic framework, which allows a probability of occurrence to be associated with a predicted travel time. A series of five models is used to account for different concepts about the groundwater flow regime in the deep basalts. The simplest model considers two-dimensional, horizontal groundwater flow in the basalt flow top overlying the

repository. Complexity is added to this model by superimposing various amounts of vertical groundwater flow. Results indicate a probability of at least 0.97 that travel time exceeds 1,000 years, and a probability of between 0.78 and 0.97 that travel time exceeds 10,000 years. 37 refs., 13 figs., 5 tabs.

4859 (RHO-BWI-TRP-004) **Geomechanics laboratory characterization of borehole RRL-2 rock core.** Sublette, W.R. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. 21 Jan 1985. 25p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

A series of geomechanics laboratory tests were conducted on the basalt core from borehole RRL-2 for the purpose of characterizing the basalt with respect to its physical, mechanical, and thermal properties. The objectives of this testing were to characterize the basalt properties in the area of the proposed shaft and repository site. These rock properties will be used in designing the Exploratory Shaft, evaluating basalt drillability, selecting the Exploratory Shaft breakout horizon, and developing a repository upgraded conceptual design. 10 refs., 1 fig., 6 tabs.

4860 (RHO-BWI-TS-008) **Slow-strain-rate testing 9%Cr, 1%Mo wrought steel and ASTM A27 cast steel in Hanford Grande Ronde groundwater.** Pitman, S.G. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Oct 1984. 20p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

Strength and ductility data are presented for a cast low-carbon steel (A27) and a low-alloy steel (A387) in both air and a basalt groundwater environment. These data are used in conjunction with fracture mode analyses to evaluate the susceptibility of these materials to environmentally assisted cracking processes. Implications of the observed behavior relative to waste package container design and container material selection are discussed. The work was performed during FY 1984. 1 ref., 5 figs., 6 tabs.

4861 (RHO-BWI-TS-012) **Short-term stress corrosion cracking tests for A36 and A387-9 steels in simulated Hanford groundwater.** James, L.A. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. 1985. 69p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

Relatively short-term (approximately 2000 hour) tests were conducted on precracked self-loaded fracture mechanics specimens of two candidate container materials in simulated Hanford groundwater at two temperatures: 150°C and 250°C. The two materials tested were wrought ASTM A36 A387-9 steels, and three different levels of applied stress intensity (K) were tested for each material/temperature combination. The results of these short term tests suggested no crack extension in the A36. The results for the A387-9 steel were inconclusive as to whether limited crack extension occurred or not. On-going longer term tests should help clarify the uncertainty. The factors influencing the accuracy of this type of fracture mechanics tests are also discussed. 22 refs., 17 figs., 10 tabs.

4862 (RHO-BWI-TY-001) **Repository horizon identification report: Volume 1, Technical data on candidate repository horizons: Revision 0-0.** Long, P.E. (ed.). Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Oct 1983. 567p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This document reports on the process of ranking to identify a preferred candidate repository horizon beneath the reference repository location from among a set of potential candidate horizons. The document is in draft form at this time. It is presented in two volumes. The first volume reports the available geologic, geohydrologic, and engineering data considered and utilized for the ranking analysis. Volume II discusses the decision analysis methodology used in this study along with the input measures and results. The result of this study does not represent the final selection of a candidate repository horizon. The preferred candidate repository horizon will be the focus of further field, laboratory, and design activities as well as in situ testing. 120 refs., 123 figs., 83 tabs.

4863 (RHO-BWI-VP-002) **Verification plan for equipment installation Block Test No. 1 (NSTF [Near-Surface Test Facility] Test No. 5).** Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Jan 1982. 118p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This revision reports the results of equipment verification inspection and tests conducted preparatory to running the Block Test No. 1 Acceptance Test Procedure (SD-BWI-ATP-002). 1 tab.

4864 (RHO-BWI-VP-005) **BWIP [Basalt Waste Isolation Project] Verification Plan (BVP).** Zambas, P.G. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. 9 Jun 1989. 31p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

The verification process is used to review, confirm, or substantiate data and analysis and hardware and software design. One or more methods are used to provide assurance that design items meet specified safety and performance criteria and that the site data and analysis accurately characterize the site. The Basalt Waste Isolation Project (BWIP) Verification Plan (BVP) outlines the broad requirements of the verification process in compliance with the document hierarchy of the project. 4 refs., 1 tab.

4865 (RHO-BWI-VP-010380-01-Rev.1) **Verification plan for equipment installation, full scale heater tests #1 and #2: Revision 1.** Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Jan 1980. 122p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

This Verification Plan for Equipment Installation, Full Scale Heater Test #1 and #2 (VP-FS #1 & #2) presents the Hold Points and equipment items (check sheets) to document the installation effort. This plan complements, but does not duplicate, the Title 3 inspection.

4866 (RHO-BW-ST-51P) **Hydrologic test results for the upper Cohassett flow interior at borehole RRL-2, Hanford Site, Washington State.** Strait, S.R.; Spane, F.A. Jr. Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations. Mar 1984. 38p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract AC06-77RL01030. Available from OSTI; INIS.

The results and description of hydrologic test activities for the upper Cohassett flow interior at borehole RRL-2 over the depth interval 3,057 to 3,172 feet are presented in this report. Hydrologic tests conducted include an over-pressure pulse test and a constant head injection test. Preliminary results from hydrologic tests performed indicate transmissivity values ranging from 1.8×10^{-6} to 1.7×10^{-4} square feet per day, with an assigned best estimate of 1.7×10^{-4} square feet per day. The best estimates of equivalent hydraulic conductivity, based on a thickness for the effective test interval of 115 feet, is 1.5×10^{-6} feet per day. Best-estimate values obtained from testing are consistent with results previously reported for similar Grande Ronde Basalt horizons. 12 refs., 6 figs., 3 tabs.

4867 (SAND-89-0536) **Interpretation of H-11B4 hydraulic tests and the H-11 multipad pumping test of the Culebra dolomite at the Waste Isolation Pilot Plant (WIPP) site.** Beauheim, R.L. Sandia National Labs., Albuquerque, NM (USA). Sep 1989. 197p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE90003307. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

Drillstem tests, slug tests, a small-scale pumping test, and a large-scale pumping test of the Culebra Dolomite Member of the Rustler Formation were performed in 1988 at the H-11 hydropad at the Waste Isolation Pilot Plant (WIPP) site in southeastern New Mexico. The drillstem, slug, and small-scale pumping tests were conducted in well H-11b4 to evaluate well and aquifer properties in preparation for a tracer test. The large-scale pumping test, known as the H-11 multipad test, was performed by pumping well H-11b1 in the southern part of the WIPP site at a rate of six gpm for 63 days and monitoring drawdown and recovery responses in three other wells on the H-11 hydropad and at 11 observation wells within a three-mile radius. Responses were observed in 10 of these distant wells. The H-11 multipad pumping test complemented the H-3

and WIPP-13 multipad pumping tests conducted in the central and northern portions of the WIPP site in late 1985 and early 1987, respectively. 67 refs., 124 figs., 31 tabs.

4868 (SKB-JSSP-TR–88-02) **JSS Project Phase V: Final report. Testing and modelling of the corrosion of simulated nuclear waste glass powders in a waste package environment.** Bjoerner, I.K. (Studsvik Energiteknik AB, Nykoeping (Sweden)); Zwicky, H.U.; Magrabi, C.; Ewing, R.C.; Grambow, B.; CRIEPI, NAGRA, SKB collaboration. CRIEPI, NAGRA, SKB collaboration. Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden). Mar 1988. 256p. Order Number DE90610977. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The report describes the results of phase V of the project and the final evaluation of the COGEMA glass data base for the whole project in terms of glass long-term performance. The effects of the following parameters and additives on the corrosion performance of the COGEMA glass were studied explicitly or implicitly by comparison with data from JSS phases 1 and to 4: - time, - temperature, - S/V, - pH, - radioactivity (ABS-118 and R7T7 versus JSS-A glass), - bentonite, - magnetite, - bentonite + magnetite. The results showed that even if there was permanent contract between the glass and groundwater in a respository at 90 degree C and fractured glass block would not be fully altered within 10000 years provided that the groundwater flow rate did not exceed 100 l/yr/glass block. At a lower, more typical, temperature of about 50 degree C the durability may be higher. It is unlikely that, for long-term contact with groundwater, the glass block would remain intact at this temperature for time periods longer than 1 million years. The long-term rate controls the release of soluble elements. The release of sparingly soluble glass constituents is lower and, although controlled by the flow rate, is not proportional to it. The chemical effect of bentonite was of minor importance for the evaluation of the long-term alteration of the glass matrix, but the sorption capacity of bentonite significantly reduces the concentrations of radionuclides such as Cs in the contacting groundwater. The magnitude of the effect of magnetite on glass corrosion depended on the corrosion rate of the steel canister and/or the rate of iron silicate formation or multilayer silica sorption. This implies that in the presence of iron canisters the rate of glass corrosion will significantly depend on redox conditions.

4869 (UCRL–101615) **Prototype Engineered Barrier System Field Tests: Progress report.** Ramirez, A.L.; Beatty, J.; Buscheck, T.A.; Carlson, R.; Daily, W.; LaTorre, V.R.; Lee, K.; Lin, Wunan; Mao, Nai-hsien; Nitao, J.J.; Towse, D.; Ueng, Tzou-Shin; Watwood, D.; Wilder, D. Lawrence Livermore National Lab., CA (USA). 26 Jul 1989. 10p. Sponsored by U.S. DOE Radioactive Waste Management. DOE Contract W-7405-ENG-48. (CONF-890928–17: Nuclear waste isolation in the unsaturated zone: FOCUS '89, Las Vegas, NV (USA), 18-21 Sep 1989). Order Number DE90003623. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

This paper presents selected preliminary results obtained during the first 54 days of the Prototype Engineered Barrier System Field Tests (PEBSFT) that are being performed in G-Tunnel within the Nevada Test Site. The test described is a precursor to the Engineered Barrier Systems Field Tests (EBSFT). The EBSFT will consist of in situ tests of the geohydrologic and geochemical environment in the near field (within a few meters) of heaters emplaced in welded tuff to simulate the thermal effects of waste packages. The PEBSFTs are being conducted to evaluate the applicability of measurement techniques, numerical models, and procedures for future investigations that will be conducted in the Exploratory Shaft Facilities of the Yucca Mountain Project (YMP). The paper discusses the evolution of hydrothermal behavior during the prototype test, including rock temperatures, changes in rock moisture content, air permeability of fractures, gas pressures, and rock mass gas-phase humidity. 10 refs., 12 figs.

4870 (UCRL–101882) **A constitutive theory for stress wave propagation across closed fluid-filled rough fractures.** Wijesinghe, A.M. (Lawrence Livermore National Lab., CA (USA)). Lawrence Livermore National Lab., CA (USA). 22 Aug 1989. 16p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-891241–2: International symposium on wave propagation in granular media, San Francisco, CA (USA), 10-14 Dec 1989). Order Number DE90001168. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this paper we present a mechanistic constitutive theory that treats single fractures as general singular interfaces across which the displacements as well as the velocities and tractions in the adjoining media become discontinuous. Viewing the fracture as a two-dimensional surface-continuum, we derive the conservation laws that govern the transport of mass and momentum in the fracture by applying continuum averaging methods to the rough fracture geometry. In doing so, special attention is paid to modeling the impact of the discontinuity in solid displacement on the movement of the fluid and solid phases within the fracture. Constitutive laws are developed for both fracture deformation and fluid-solid interactions within the fracture. By stochastic averaging of the solution to the one-dimensional unsteady Navier-Stokes equation over a random distribution of fracture widths, hereditary response functions are derived for the fluid-solid interactions within the fracture. These relationships incorporate statistical measures of fracture surface roughness and are valid upto moderately high frequencies at which unsteady fluid inertia effects become significant. 23 refs.

4871 (WHC-SA–0607) **Hanford Waste Vitrification Plant technology progress.** Wolfe, B.A. (Westinghouse Hanford Co., Richland, WA (USA)); Allen, C.R. Westinghouse Hanford Co., Richland, WA (USA). Oct 1989. 16p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-87RL10930. (CONF-891006–9: Joint international waste management conference, Kyoto (Japan), 23-28 Oct 1989). Order Number DE90003356. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Hanford Waste Vitrification Plant (HWVP) is being designed to immobilize a variety of defense liquid high-level and transuranic wastes at the Hanford Site. These wastes will be immobilized in a borosilicate glass waste form and temporarily stored onsite until a qualified geologic waste repository is ready for permanent disposal. Specific technical issues are being addressed so that the plant can be designed and operated to produce a waste form that meets the requirements for permanent disposal. This paper reports the progress to date in addressing these issues. 5 figs., 2 tabs.

4872 **Coupled thermo-hydro-mechanical processes associated with a radioactive waste repository.** Tsang, C.F. (Lawrence Berkeley Lab., CA (USA). Earth Sciences Div.). 1p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-881143–: American Institute of Chemical Engineers annual meeting, Washington, DC (USA), 27 Nov - 2 dec 1988).

Technical Paper 46B.

The performance assessment of a nuclear waste geologic repository presents a scientific and technical problem of a scope far beyond the evaluation of most civil and geologic constructions. First performance prediction must be made for tens of thousands of years, and a secondly, in calculating potential leakage rates from a repository to the biosphere the authors must determine not only the mean or average travel time but also the shorter travel times of low concentrations. These two criteria demand an understanding of all significant physical and chemical processes likely to occur around a nuclear waste repository. In particular, processes coupling thermal transfer fluid flow, mechanical deformation and chemical reactors, which may be slow in a laboratory time scale, may become very important. This paper gives a general survey on the subject, with specific examples of a number of relevant coupled thermo-hydro-mechanical processes associated with nuclear waste repository.

4873 **The use of sulfuric/phosphoric acid treated peat for radioactive wastewater treatment.** Bynum, R.V. (Rockwell International, Rocky Flats Plant, PO Box 464, Golden, CO (US)); Navratil, J.D. pp. 469 of Chemical separations. King, C.J.; Navratil, J.D. Litarvin Literature, Arvada, CO (1986). (CONF-860411–: 1. international conference on separations science and technology, New York, NY (USA), 15-17 Apr 1986).

Peat is a relatively inexpensive material which possesses a native cation exchange capacity. Efforts to utilize peat have been hampered by its low permeability to water and its tendency to severely leach in water at pH 6. These disadvantages have been significantly minimized by treating the peat with a combination of concentrated sulfuric and phosphoric acids, resulting in a particulate material which is permeable to water and resistant to leaching. The acid

treatment also increases the cation exchange capacity of the peat. This paper describes preliminary results of both column and batch studies of the modified peat for use as an actinide adsorbent.

4874 Subseabed disposal of high-level nuclear wastes. Gomez, L.S. (Subseabed Programs Div., Sandia National Labs., Albuquerque, NM); Yayanos, A.A.; Jackson, D.W. pp. 405 of Advances in radiation biology. Volume 13. Lett, J.T Academic Press Complimentary Copy Coordinator, Marketing Dept., San Diego, CA (1987).

Subseabed disposal, like other geological disposal schemes, is a multibarrier concept that involves burial of solidified and packaged HLW or spent fuel in high-integrity canisters, tens of meters within the stable geologic formations of the deep-ocean floor. In this concept, the multiple barriers of the waste form, the canister, the clay sediments, and the ocean waters are predicted to delay migration of radionuclides until they decay to innocuous levels. The U.S. Subseabed Disposal Program (SDP) feasibility assessment program, as managed by Sandia National Laboratories, Albuquerque, New Mexico, is divided into four phases: preliminary estimation of feasibility on the basis of existing data; determination of scientific and environmental feasibility from newly acquired oceanographic and other data; determination of engineering feasibility and legal and political acceptability and demonstration of disposal facilities. The approach is designed to answer two crucial questions of isolation and emplacement.

4875 Plutonium removal from nitric acid waste streams. Muscatello, A.C. (Rockwell International, Golden, CO (US)); Navratil, J.D. pp. 469 of Chemical separations. King, C.J.; Navratil, J.D. Litarvin Literature, Arvada, CO (1986). (CONF-860411–: 1. international conference on separations science and technology, New York, NY (USA), 15-17 Apr 1986).

Separations research at the Rocky Flats Plant (RFP) has found ways to significantly improve plutonium secondary recovery from nitric acid waste streams generated by plutonium purifications operations. Capacity and breakthrough studies show anion exchange with Dowex 1.4 (50-100 mesh) to be superior for secondary recovery of plutonium. Extraction chromatography with TOPO (tri-n-octyl-phosphine oxide) on XAD-4 removes the final traces of plutonium, including hydrolytic polymer.

0530 Environmental Aspects

Refer also to citation(s) 4769, 4773, 4774, 4775, 4776, 4786, 4788, 4795, 4796, 4797, 4798, 4803, 4804, 4805, 4806, 4807, 4809, 4810, 4811, 4812, 4813, 4814, 4815, 4816, 4817, 4818, 4819, 4820, 4821, 4822, 4823, 4824, 4825, 4826, 4827, 4828, 4829, 4830, 4831, 4832, 4833, 4834, 4835, 4836, 4837, 4838, 4839, 4840, 4841, 4842, 4843, 4844, 4845, 4846, 4848, 4849, 4850, 4851, 4852, 4853, 4854, 4855, 4856, 4857, 4858, 4859, 4860, 4861, 4862, 4863, 4864, 4865, 4866, 4867, 4869, 4870, 4877, 4879, 4884, 5833, 5848, 5850, 5881

0540 Health and Safety

Refer also to citation(s) 4657, 4794, 4801, 4832, 4835, 4836, 4837, 4838, 4840, 4842, 4843, 4844, 4845, 4846, 4847, 4848, 4850, 4851, 4853, 4862

4876 (AEEW-M–2253) **Decontamination by high pressure water jetting - a power reactor application.** Bond, R.D. UKAEA Atomic Energy Establishment, Winfrith (UK). Materials Technology Div. Jul 1985. 40p. (PWR-CWG-P–(85)347). Order Number DE90609923. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Reactor circuitry at the Winfrith SGHWR has traditionally been decontaminated on a routine basis by chemical methods in order to minimise dose to operation and maintenance staff. Recent advances in chemical techniques have led to the development of LOMI reagents. More recently these have included two-stage processes allowing for preoxidation of surface oxides. Experience has shown that generally only about one half of the 60 Co activity retained in enriched chromium oxides is removed in this way. Recent work at AEEW has shown that the residual deposits may be removed by high pressure water jets and this is particularly effective when following a LOMI treatment of stainless steel surfaces; over 95% of the activity can be removed by a single pass of the jet. Further work has been undertaken to develop the method fully for reactor pipe applications. It has shown that using a centrally placed, slowly rotating nozzle traversing along the axis of the pipe, Decontamination Factors (DFs) of up to 20 were possible. A more practical approach is to allow the nozzle to find its own alignment while advancing. A system of advancing, rotating and retrieving the nozzle was identified and further trials prepared the way for a reactor operation -decontamination of part of the blowdown line in the WSGHWR. The line, 15 metres long, with two right angle bends, is made from seamless 321 stainless steel tube 4" in diameter. The main objective of the operation was to demonstrate the practicality of high pressure water jetting as a specialist decontamination technique. As a means of assessing the effectiveness, the radiation levels of the pipe before and after the process were measured using thermoluminescent dosimeters. (author).

4877 (AERE-M–3751) **Radioactive discharges and environmental monitoring. Annual report for 1988.** UKAEA Harwell Lab. (UK). 1988. 45p. Order Number DE90609912. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The United Kingdom Atomic Energy Authority's Harwell Laboratory is situated some 5 miles west of Didcot in Oxfordshire. The Laboratory carries out research into a wide range of topics associated with the UK civil nuclear power programme and additionally carries out contract research in various non-nuclear subjects. This report provides information on disposal of radioactive waste from Harwell and on associated environmental monitoring for the calendar year 1988. In most instances information has also been provided on measurements made in previous years to show the 1988 results in their historical perspective. Results specific to 1987 were presented in an earlier report (M3678). As in last year's report, a short appendix is included this year which describes some of the non-routine monitoring that was carried out during 1988. In 1985 the National Radiological Protection Board (NRPB) advised that the primary dose limit for members of the public should be 1 mSv per year. In November 1987, NRPB recommended further that the dose incurred by a member of the public should not exceed 0.5 mSv as a result of operations on a single site. No member of the public is judged to have exceeded this dose as a consequence of discharges made in 1988. Throughout this report, comparisons are made against a 1 mSv derived limit as in previous years. (author).

4878 (AERE-R–12902) **Interim report on the activity hold-up, and ease of decontamination of permanent coatings and surface treatments incorporated in a glove box floor.** Dalton, J.T. (UKAEA Harwell Lab. (UK). Chemistry Div.); Eccles, E.W.; Sutcliffe, P.W.; Turner, A.D.; Dawson, R.K. UKAEA Harwell Lab. (UK). Chemistry Div. Nov 1987. 24p. (DDTF/P–125;PCMRP–87-P8). Order Number DE90609924. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A commercial glass reinforced plastic (GRP) glove box has been equipped with 1 square foot tiles of alternative flooring materials. These comprise highly polished GRP, poly-ether-ether-ketone (PEEK), electropolished stainless steel, cold-rolled stainless steel foil, bright nickel electroplate on stainless steel and hard chrome electroplate on stainless steel. The natural GRP finish was used as a reference surface. Standard PuO_2 handling and floor abrasion operations have been carried out on a regular basis. Subsequently, the floor tiles have been decontaminated by swabbing with Arklone soaked tissues and a mass balance has determined the fraction of PuO_2 unaccounted to be about 1%. Hard, smooth surfaces are promising to give the best performance in minimizing activity retention under these abrasive conditions to $\sim 100\ \mu g\ cm^{-2}$. Glove box aerosol concentrations have also been monitored as a function of time after the completion of handling operations by air sampling and by gravity settling. After an initial rapid decrease over $\sim$ 2 hours, a steady state is reached corresponding to $\sim$ 1 ng/l of PuO_2. (author).

4879 (BNL–43228) **ALARA [as low as reasonably achievable] engineering at Department of Energy facilities: Bibliography of selected readings in radiation protection and ALARA.** Daniel, S.W.; Kaplan, E.; Dionne, B.J.; Khan, T.A.; Lane,

S.G.; Baum, J.W. Brookhaven National Lab., Upton, NY (USA). Sep 1989. 30p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC02-76CH00016. Order Number DE90003632. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This report is the first in the series of bibliographies supporting the efforts at the Brookhaven National Laboratory ALARA Center on dose reduction at DOE facilities. Abstracts for this bibliography were selected from proceedings of technical meetings, journals, research reports, and searches of the DOE Energy Data Base. The abstracts included in this report relate to operational health physics as well as other subjects which have a bearing on dose reduction. Facilities covered include: radioactive waste, uranium enrichment, fabrication, unirradiated fissile materials storage, irradiated fissile material storage, reprocessing, decommissioning, recovery, hot laboratories, tritium production, reactors (research, test and production but not power reactors), and accelerators. We have also included material in improved design, materials selection, planning, and other topics which are related to dose-reduction efforts. The report contains 68 abstracts as well as subject and author indices.

4880 (DOE/ID/12584–45) **Gamma and beta logging of underground sewer and process lines.** Rangel, M.J.; Martz, D.E.; Langner, G.H. Jr. UNC Geotech, Grand Junction, CO (USA). Nov 1989. 16p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-86ID12584. (UNC/GJ–49(TMC)). Order Number DE90002598. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The GammaSnake can be useful for locating uranium mill tailings used as backfill for sewer lines or storm drains where the lines can be readily accessed from a cleanout access port or other opening. The time required to determine if contamination is present using the GammaSnake method is considerably less than when using the delta gamma or drilling methods. There is, also, less potential hazard to the equipment operators when using the GammaSnake method. The GammaSnake method is generally limited to a distance of 100 feet or less. Used with the MAC-51B line locator, the GammaSnake method can provide useful information without extensive drilling or surveying. 7 figs., 2 tabs.

4881 (DOE/NE–0099) **Program summary for the Office of Remedial Action and Waste Technology.** USDOE Assistant Secretary for Nuclear Energy, Washington, DC (USA). Oct 1989. 24p. Sponsored by U.S. DOE Nuclear Energy. Order Number DE90004446. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The US Department of Energy is the lead Federal agency responsible for planning and implementing the programs that ensure safe and efficient management of nuclear wastes from both civilian and defense activities. Within the Department, three offices share this responsibility: the Office of Remedial Action and Waste Technology, the Office of Civilian Radioactive Waste Management, and the Office of Defense Waste and Transportation Management. This document summarizes the programs managed by the Office of Remedial Action and Waste Technology.

4882 (DOE-RW–89.046) **Demonstration of DECOS: representation of four biosphere states.** Ashton, J. (Associated Nuclear Services, Epsom (UK)). Department of the Environment, London (UK). Sep 1988. 25p. (ANS-R–595-15). Order Number DE90609917. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This report describes the use of the dynamic biosphere code, DECOS, in stand alone mode, to represent a site in four possible biosphere states. The biosphere states have been chosen to illustrate a range of conditions which may prevail at the site. The behaviour of the system in each state has been considered and the capability of DECOS to switch between the states has been demonstrated. The intention of this work is to test the function of DECOS. Results in this report are illustrative and do not form any part of a radiological assessment of the site. (author).

4883 (DOE-RW–89.047) **Review of the predictive modelling and data requirements for the long-term safety assessment of the deep disposal of low and intermediate level radioactive wastes.** Broyd, T.W. (Atkins (W.S.) and Partners, Epsom (UK)) (ed.). Department of the Environment, London (UK). Jun 1988. 158p. (WSA-TR–23). Order Number DE90609918. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

This report considers the Her Majesty's Inspectorate of Pollution research and modelling requirements for a robust post-closure radiological risk assessment methodology applicable to the deep disposal of Low-Level Wastes and Intermediate-Level Wastes. Two disposal concepts have been envisaged: horizontal tunnels or galleries in a low permeability stratum of a sedimentary sequence located inland; vertical boreholes or shafts up to 15m diameter lined with concrete and of the order 500m to 1000m deep sunk into the seabed within territorial coastal waters of the United Kingdom. (author).

4884 (INIS-BR–1733, pp. 81-91) **Environmental effects of radiations and fuel cycle.** Paschoa, A. (Pontificia Univ. Catolica do Rio de Janeiro, RJ (Brazil)). Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1977. (In Portuguese). In *Environmental protection and safety of nuclear facilities.* Order Number DE90608315. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

A summary about the radiation effects to the environment and considerations about the maximum permissible dose to the population are presented.

4885 (WHC-SA–0775) **In-place HEPA [high efficiency, particulate air] filter testing at Hanford: Operating experiences, calibrations, and lessons learned.** Flores, D.S.; Decelis, D.G. Westinghouse Hanford Co., Richland, WA (USA). Oct 1989. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-87RL10930. (CONF-8910260–2: Plutonium/uranium recovery operations conference, Oak Ridge, TN (USA), 24-26 Oct 1989). Order Number DE90003357. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

High Efficiency, Particulate Air (HEPA) Filters provide a minimum of 99.97% removal efficiency for particles greater than or equal to .3 microns in diameter. Each HEPA filter installation at Hanford is, at specified intervals, functionally tested for leaks. The test procedure involves a dioctylphthalate (DOP) smoke generator and a calibrated airborne particle detector. The DOP generator produces smoke of a known quantitative particle size distribution upstream of the filter. The airborne particle detector is first placed upstream, and then downstream of the filter to determine percent penetration. The smoke generator is characterized using a calibrated laser spectrometer, and the particle detector is calibrated using a calibrated picoammeter. 2 refs., 4 figs.

0550 Safeguards, Inspection, and Accountability

Refer also to citation(s) 5106, 5369

4886 (ENEA-RT-COMB–89-1) **Feasibility study for the implementation of NRTMA system for an industrial nuclear fuel fabrication plant.** Aparo, M. (ENEA, Casaccia (Italy). Centro Ricerche Energia); Dionisi, M.; Graziani, M.; Remetti, R. ENEA, Rome (Italy). 1989. 19p. (In Italian). Order Number DE90610949. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In the frame of the problems arising from the fissile materials safeguards into the facilities of the nuclear fuel cycle, the International Safeguards devoted, in the recent years, R and D efforts on a new Dynamic Accountability procedures (Near Real Time Material Accountancy) appealing to the needs of timeliness in detecting diversion. This paper deals with a feasibility study of a NRTMA system to be applied to a nuclear fuel fabrication plant for light water reactor. Such a feasibility study was performed by developing a dynamic model and a computer program, written in FORTRAN 77, in order to simulate all the processes and measurement procedures involved in the nuclear material accountancy.

4887 (IAEA-R–4658-F) **Development of a personal computer based facility-level SSAC component and inspector support system. Final report for the period 1 January 1987 - 30 June 1989.** Markov, A. Komitet za Mirno Izpolzuvane na Atomnata Energiya, Sofia (Bulgaria); International Atomic Energy Agency, Vienna (Austria). Aug 1989. 7p. Order Number DE90610392. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Research Contract No. 4658/RB was conducted between the IAEA and the Bulgarian Committee on Use of Atomic Energy for

Peaceful Purposes. The contract required the Committee to develop and program a personal computer based software package to be used as a facility-level computerized State System of Accounting and Control (SSAC) at an off-load power reactor. The software delivered, called the National Safeguards System (NSS) keeps track of all fuel assembly activity at a power reactor and generates all ledgers, MBA material balances and any required reports to national or international authorities. The NSS is designed to operate on a PC/AT or compatible equipment with a hard disk of 20 MB, color graphics monitor or adaptor and at least one floppy disk drive, 360 Kb. The programs are written in Basic (compiler 2.0). They are executed under MS DOS 3.1 or later.

4888 (WHC-SA–0776) **PISCES [Plant Instrumentation Surveillance, Calibration and Evaluation System]: A computerized instrument calibration recall system.** Adams, D.D.; Berry, D.O. Westinghouse Hanford Co., Richland, WA (USA). Oct 1989. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC06-87RL10930. (CONF-8910260–3: Plutonium/uranium recovery operations conference, Oak Ridge, TN (USA), 24-26 Oct 1989). Order Number DE90003359. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Plant Instrumentation Surveillance, Calibration and Evaluation System (PISCES) tracks calibration and functional testing. We introduced it in 1983 at Hanford's 200 East and 200 West Areas. The first affected facility was Plutonium and Uranium Extraction (PUREX). Other facilities followed until the last major facility was added in July of 1988. Initial system structure was a mainframe computer database with remote access from an IBM PC via telephone modem. Program language was Fortran. Acquisition of a Micro Computer Fileserver and small local area network in 1984/85 enabled 200 Area Maintenance Engineering to enhance update and report capabilities by reprogramming in dBASE II. We are continuing to add upgrades to PISCES to provide a better multi-user environment. The language of choice is Advanced Revelation. This database management system was selected and is being used by Boeing Computer Services, Richland to develop the Site Wide Job Control System.

4889 (WSRC-RP–89-308) **A systematic approach for implementation of new MC and A requirements.** Wilson, W.A. Westinghouse Savannah River Co., Aiken, SC (USA). 1989. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. (CONF-891103–51: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE90003506. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In early 1988 the Material Control and Accountability Section at the Savannah River Site (SRS) was given the task of implementing DOE MC and A Order, 5633.3. The requirements of this Order are significantly different than those of the previous DOE MC and A Order. This, coupled with the size and complexity of operations at SRS made implementation of this Order a formidable task. The Material Control and Accountability Section at SRS took a somewhat unique approach. First, the order was broken down into 240 individual requirements. Each requirement was given a number, summarized in a short phrase, and entered into a computer database. This database was then used to prepare a check sheet for evaluating each Material Balance Area (MBA). 9 figs.

0560 Legislation and Regulations

Refer also to citation(s) 5106, 6190

4890 (IAEA-INFCIRC–254(Add.12)) **Communications received from certain Member States regarding guidelines for the export of nuclear material, equipment or technology.** International Atomic Energy Agency, Vienna (Austria). Oct 1989. 1p. Order Number DE90610380. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The document reproduces the text of a letter dated 14 September 1989 received by the IAEA Director General from the Resident Representative of Norway relating to the export of nuclear material, equipment or technology.

4891 (IAEA-INFCIRC–254(Add.13)) **Communications received from certain Member States regarding guidelines for the export of nuclear material, equipment or technology.** International Atomic Energy Agency, Vienna (Austria). Oct 1989. 1p. Order Number DE90610381. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Hard copies are available in English and French from IAEA Div. of Publications, Distribution Unit.

The document reproduces the Note Verbale dated 16 September 1989 received by the Director General from the Permanent Mission of Belgium relating to the export of nuclear material, equipment or technology.

4892 (INIS-mf–11539) **Law at Malaysia act A250. Radioactive substances (amendment) act 1974.** International Atomic Energy Agency, Vienna (Austria). 1974. 12p. Order Number DE90608874. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

An act to make provision for the control of radioactive substances and irradiating apparatus and for matters connected. (author).

07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

0701 Physical Isotope Separation

Refer also to citation(s) 6454

4893 (IAEA-TECDOC–515) **Fission molybdenum for medical use. Proceedings of a technical committee meeting held in Karlsruhe, 13-16 October 1987.** International Atomic Energy Agency, Vienna (Austria). Jun 1989. 155p. (CONF-8710503–: Technical committee on fission molybdenum for medical use, Karlsruhe (Germany, F.R.), 13-16 Oct 1987). Order Number DE90608568. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Technetium-99m is today the most widely used radionuclide in modern diagnostic nuclear medicine and very likely this will remain so for the foreseeable future. The over increasing demand for this radionuclide, both in developed and developing countries, may call for a greater production capacity and availability, particularly in the developing countries. However, there are indications that the availability of highly enriched uranium targets used for the production of ^{99}Mo generators may be restricted in the future and that new or modified target technologies and separation methods have to be investigated to ensure a high quality and economical ^{99}Mo/^{99m}Tc product when using low enriched uranium targets. The following questions were discussed at this meeting: target technology development, current-process technology, waste disposal, economic factors, proliferation concerns, safeguards, quality assurance and control possibilities for technology transfer. All the contributions presented at the meeting (13 papers) are included in the report. A separate abstract was prepared for each of these papers. Refs, figs and tabs.

4894 (IAEA-TECDOC–515, pp. 47-64) **Production techniques of fission ^{99}Mo.** Sameh, A.A. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Radiochemie); Ache, H.J. International Atomic Energy Agency, Vienna (Austria). Jun 1989. (CONF-8710503–: Technical committee on fission molybdenum for medical use, Karlsruhe (Germany, F.R.), 13-16 Oct 1987). In *Fission molybdenum for medical use. Proceedings of a technical committee meeting held in Karlsruhe, 13-16 October 1987.* Order Number DE90608568. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Generally two different techniques are available for molybdenum-99 production for use in medical technetium-99 generation. The first one is based on neutron irradiation of molybdenum targets of natural isotopic composition or enriched in molybdenum-98. In these cases the Mo-99 is generated via the nuclear reaction ^{98}Mo (n,γ) ^{99}Mo. Although this process can be carried out at low expenditure it gives a product of low specific activity and, hence, restricted applicability. In a second process Mo-99 is obtained as a result of the neutron induced fission of U-235 according to ^{235}U (n,f) ^{99}Mo. This technique provides a product with a specific activity several orders

of magnitude higher than that obtained from the ^{98}Mo (n,γ) ^{99}Mo nuclear reaction and perhaps even more important up to several thousands curies of Mo-99 per production run. In this paper a modern production procedure of Mo-99 via the fission reaction, which was developed at the Institute of Radiochemistry of the Nuclear Research Centre Karlsruhe will be described. The targeting, irradiation of U-235, the separation and purification steps involved as well as the recycling of the non-converted U-235, which should be a major consideration in any production technique, will be discussed. (author). 24 refs, 14 figs, 1 tab.

4895 (IAEA-TECDOC–515, pp. 65-81) **Production of fission ^{99}Mo by processing irradiated natural uranium targets.** Hladik, O. (Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic)); Bernhardt, G.; Boessert, W.; Muenze, R. International Atomic Energy Agency, Vienna (Austria). Jun 1989. (CONF-8710503–: Technical committee on fission molybdenum for medical use, Karlsruhe (Germany, F.R.), 13-16 Oct 1987). In *Fission molybdenum for medical use. Proceedings of a technical committee meeting held in Karlsruhe, 13-16 October 1987.* Order Number DE90608568. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

A production process for fission Mo-99 is proposed in which natural uranium as uranium oxide is used as target material. This procedure is particularly interesting for those which do not dispose of enriched nuclear fuel material. Approximately 400g of uranium oxide enclosed in irradiation cans are dissolved in nitric acid after irradiation for 100 hrs at a neutron flux of 5.10^{13} cm^{-2} s^{-1} in a research reactor. The separation of Mo-99 from the fuel-fission product solution is performed by ion exchange with alumina in a chromatographic column. Final purification includes the repeated chromatographic separation and subsequently a sublimation stage. By this process about 100 Ci of Mo-99 is obtained at the end of the production process. The quality (radiochemical and radioactive purity) corresponds to international standards to medically used Mo-99/Tc-99m generators. (author). 6 refs, 5 figs, 3 tabs.

4896 (IAEA-TECDOC–515, pp. 83-97) **Research and development of ^{99}Mo production technology in Japan.** Kudo, H. (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan)); Yamabayashi, N.; Iguchi, A.; Shikata, E. International Atomic Energy Agency, Vienna (Austria). Jun 1989. (CONF-8710503–: Technical committee on fission molybdenum for medical use, Karlsruhe (Germany, F.R.), 13-16 Oct 1987). In *Fission molybdenum for medical use. Proceedings of a technical committee meeting held in Karlsruhe, 13-16 October 1987.* Order Number DE90608568. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

A fission ^{99}Mo plant was constructed in 1977 at the facilities of the Japan Atomic Energy Research Institute (JAERI). UO_2 pellets (2.6% enrichment) were utilized on target material containing 120g of UO_2. The pellets were irradiated in the JRR-2 and JRR-3 reactors up to 7 days at a neutron flux of 2 or 3 x 10^{13} n/cm^2 x sec. About 20 Ci of ^{99}Mo per week was routinely produced for 39 weeks. However, due to severe constraints of a research establishment, commercial production runs had been stopped. This paper provides information on the target configuration, post-irradiation separation process and waste disposal problems. (author). 14 refs, 4 figs, 3 tabs.

4897 (IAEA-TECDOC–515, pp. 99-113) **Preliminary investigations for technology assessment of ^{99}Mo production from leu targets.** Vandegrift, G.F. (Argonne National Lab., IL (USA)); Chaiko, D.J.; Heinrich, R.R.; Kucera, E.T.; Jensen, K.J.; Poa, D.S.; Varma, R.; Vissers, D.R. International Atomic Energy Agency, Vienna (Austria). Jun 1989. (CONF-8710503–: Technical committee on fission molybdenum for medical use, Karlsruhe (Germany, F.R.), 13-16 Oct 1987). In *Fission molybdenum for medical use. Proceedings of a technical committee meeting held in Karlsruhe, 13-16 October 1987.* Order Number DE90608568. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

This paper presents the results of preliminary studies on the effects of substituting low enriched uranium (LEU) for highly enriched uranium (HEU) in targets for the production of fission product ^{99}Mo. Issues that are addressed include (1) purity and yield of the $^{99}Mo/^{99m}Tc$ product, (2) fabrication of LEU targets and related concerns, and (3) disposal of radioactive waste. Laboratory experimentation was part of the efforts for issues (1) and (2); thus far, radioactive waste disposal has only been addressed in a paper study. Although the reported results are still preliminary, there is reason to be optimistic about the feasibility of utilizing LEU targets for ^{99}Mo production. (author). 37 refs, 1 fig., 5 tabs.

4898 (IAEA-TECDOC–515, pp. 115-128) **Continuing investigations for technology assessment of ^{99}Mo production from leu targets.** Vandegrift, G.F. (Argonne National Lab., IL (USA)); Kwok, J.D.; Marshall, S.L.; Vissers, D.R.; Matos, J.E. International Atomic Energy Agency, Vienna (Austria). Jun 1989. (CONF-8710503–: Technical committee on fission molybdenum for medical use, Karlsruhe (Germany, F.R.), 13-16 Oct 1987). In *Fission molybdenum for medical use. Proceedings of a technical committee meeting held in Karlsruhe, 13-16 October 1987.* Order Number DE90608568. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Currently much of the world's supply of ^{99m}Tc for medical purposes is produced from ^{99}Mo derived from the fissioning of high enriched uranium (HEU). This paper presents the results of our continuing studies on the effects of substituting low enriched uranium (LEU) for HEU in targets for the production of fission product ^{99}Mo. Improvements in the electrodeposition of thin films of uranium metal continue to increase the appeal for the substitution of LEU metal for HEU oxide films in cylindrical targets. The process is effective for targets fabricated from stainless steel or zircaloy. Included is a cost estimate for setting up the necessary equipment to electrodeposit uranium metal on cylindrical targets. Further investigations on the effect of LEU substitution on processing of these targets are also reported. Substitution of uranium silicides for the uranium-aluminium alloy or uranium aluminide dispersed fuel used in current target designs will allow the substitution of LEU for HEU in these targets with equivalent ^{99}Mo-yield per target and no change in target geometries. However, this substitution will require modifications in current processing steps due to (1) the insolubility of uranium silicides in alkaline solutions and (2) the presence of significant quantities of silicate in solution. Results to date suggest that substitution of LEU for HEU can be achieved. (author). 30 refs, 4 figs, 3 tabs.

4899 (IAEA-TECDOC–515, pp. 129-132) **Production of fission ^{99}Mo, ^{131}I and ^{133}Xe.** Salacz, J. (Institut National des Radioelements, Brussels (Belgium)). International Atomic Energy Agency, Vienna (Austria). Jun 1989. (CONF-8710503–: Technical committee on fission molybdenum for medical use, Karlsruhe (Germany, F.R.), 13-16 Oct 1987). In *Fission molybdenum for medical use. Proceedings of a technical committee meeting held in Karlsruhe, 13-16 October 1987.* Order Number DE90608568. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

The paper describes in general the production programmes of ^{99}Mo, ^{131}I and ^{133}Xe at IRE by irradiating and reprocessing uranium targets. Given are technical data regarding the target technology, reactor and neutron flux requirements as well as the transport of irradiated targets. Different reactors are used for the irradiation of IRE's targets so that the different irradiation devices have been adapted to encounter the various conditions of the reactor characteristics and to obtain the desired activity by loading and unloading the targets independently of the reactor operation. This paper is reproduced under the explicit authorization of the Director General of the Institut National des Radioelements. (author). 6 refs, 6 figs.

4900 (IAEA-TECDOC–515, pp. 133-135) **Irradiation of ^{235}U in the OSIRIS reactor for the production of ^{99}Mo, ^{131}I and ^{133}Xe radioisotopes.** Marchand, L. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). International Atomic Energy Agency, Vienna (Austria). Jun 1989. (CONF-8710503–: Technical committee on fission molybdenum for medical use, Karlsruhe (Germany, F.R.), 13-16 Oct 1987). In *Fission molybdenum for medical use. Proceedings of a technical committee meeting held in Karlsruhe, 13-16 October 1987.* Order Number DE90608568. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

The irradiation device is centered in a beryllium plug with a height roughly equal to that of the core. By using a target holder system, 3 targets can be placed in the irradiation site with a water circulation at a rate of approximately 7 m s^{-1}. The handling is completely done underwater as well as for loading and unloading into the shipping container. This paper is reproduced under the explicit authorization of the Director General of the Institut National des Radioelements. (author). 3 figs.

4901 (IAEA-TECDOC–515, pp. 137-139) **Irradiation of ^{235}U at the BR2 reactor for the production of ^{99}Mo, ^{131}I and ^{133}Xe radioisotopes. Short presentation of the DGR loop.** Baugnet, J.M. (Centre d'Etude de l'Energie Nucleaire, Mol (Belgium)); Blondeel, G. International Atomic Energy Agency, Vienna (Austria). Jun 1989. (CONF-8710503–: Technical committee on fission molybdenum for medical use, Karlsruhe (Germany, F.R.), 13-16 Oct 1987). In *Fission molybdenum for medical use. Proceedings of a technical committee meeting held in Karlsruhe, 13-16 October 1987.* Order Number DE90608568. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

A special loop, called the DGR, has been studied to allow the heat evacuation by pressurized water. The in-pile section of this loop consists of a thimble tube hermetically sealed with respect to the reactor primary circuit. Two in-pile sections can irradiate simultaneously 6 targets. This paper is reproduced under the explicit authorization of the Director General of the Institut National des Radioelements. (author). 3 figs, 1 tab.

4902 (IAEA-TECDOC–515, pp. 141-142) **Irradiation of ^{235}U in the HFR Petten for the production of ^{99}Mo, ^{131}I and ^{133}Xe radioisotopes.** Konrad, J. (Commission of the European Communities, Petten (Netherlands). Joint Nuclear Research Center). International Atomic Energy Agency, Vienna (Austria). Jun 1989. (CONF-8710503–: Technical committee on fission molybdenum for medical use, Karlsruhe (Germany, F.R.), 13-16 Oct 1987). In *Fission molybdenum for medical use. Proceedings of a technical committee meeting held in Karlsruhe, 13-16 October 1987.* Order Number DE90608568. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

The irradiation can take place in the PSF (Pool Side Facility) or in a special in-core facility called TRIO-FIT. In the PSF, two positions with high neutron beams allow to irradiate 6 targets whereas the TRIO-FIT accepts 9 targets in three parallel channels, simultaneously. This paper is reproduced under the explicit authorization of the Director General of the Institut National des Radioelements. (author). 4 refs, 2 figs.

4903 (IAEA-TECDOC–515, pp. 143-148) **Irradiation of ^{235}U in the SILOE reactor for the production of ^{99}Mo, ^{131}I and ^{133}Xe radioisotopes.** Galtier, J. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). International Atomic Energy Agency, Vienna (Austria). Jun 1989. (CONF-8710503–: Technical committee on fission molybdenum for medical use, Karlsruhe (Germany, F.R.), 13-16 Oct 1987). In *Fission molybdenum for medical use. Proceedings of a technical committee meeting held in Karlsruhe, 13-16 October 1987.* Order Number DE90608568. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

The irradiation device occupies a position located in the peripheral area of the reactor core behind the beryllium reflector. This facility can contain 12 targets and consists of a coolant guide and four target holders. The targets are unloaded into a hot cell with a hermetic connection with the special shipping container. This paper is reproduced under the explicit authorization of the Director General of the Institut National des Radioelements. (author). 8 figs, 2 tabs.

0702 Radiation Sources

Refer also to citation(s) 5473, 5544, 5545, 5546, 5548

4904 (IAE–2015/DN/I/A) **Industrial applications of radioisotope techniques in Poland.** Michalik, J.St. Institute of Atomic Energy, Otwock-Swierk (Poland). 1985. 113p. Order Number DE90610933. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

Received in 1988.

A general review of applications of radioisotope techniques in the Polish industry for about 25 years is given. The radiotracer methods used in metallurgy, hydrometallurgy, glass industry, oil and petroleum industries, in material testing and in other industries are described. Neutron activation analysis methods as well as nuclear gauges for industry (thickness meters, density meters, conveyer belt weigher, acid concentration meters and others) are also presented. The economic advantages of industrial applications of radioisotope techniques are described too. 42 refs., 43 figs., 11 tabs. (author).

4905 (INIS-mf–11562, pp. 35) **Monitoring radioactivity escape during production of planar ^{241}Am sources.** Koten, J. (Ustav pro Vyzkum, Vyrobu a Vyuziti Radioisotopu, Prague (Czechoslovakia)); Marsal, J.; Babicka, J. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. AMERICIUM 241/sealed sources; SEALED SOURCES/radiation monitoring; RADIATION PROTECTION; WORKING CONDITIONS

0704 Economic, Industrial, and Business Aspects

Refer also to citation(s) 5547, 5549, 5550, 5740

08 HYDROGEN

0801 Production

Refer also to citation(s) 4558

09 BIOMASS FUELS

4906 (CONF-8903174–) **The third Pacific Basin biofuels workshop: Proceedings.** Bull, S.R. Hawaii Natural Energy Inst., Honolulu, HI (USA). 1989. 173p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. From 3. Pacific Basin biofuels workshop; Waianae, HI (USA); 27-28 Mar 1989. Order Number DE90002523. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

Among the many compelling reasons for the development of biofuels on remote Pacific islands, several of the most important include (1) a lack of indigenous fossil fuels necessitates their import at great economic loss to local island economics, (2) ideal conditions for plant growth exist on many Pacific islands to produce yields of biomass feedstocks, (3) gaseous and liquid fuels such as methane, methanol and ethanol manufactured locally from biomass feedstocks are the most viable alternatives to gasoline and diesel fuels for transportation, and (4) the combustion of biofuels is cleaner than burning petroleum products and contributes no net atmospheric CO_2 to aggravate the greenhouse effect and the subsequent threat of sea level rise to low islands. Dr. Vic Phillips, HNEI Program Manager of the "Hawaii Integrated Biofuels Research Program," which is funded by the US Department of Energy and administered through the Solar Energy Research Institute, welcomed 60 participants to the Third Pacific Basin Biofuels Workshop at the Sheraton Makaha Hotel, Waianae, Oahu, on March 27–28, 1989. The objectives of the workshop were to update progress since the Second Pacific Basin Biofuels Workshop in April 1987 and to develop a plan for action for biofuels R & D, technology transfer, and commercialization now (immediate attention), in the near-term (less than two years), in the mid-term (three to five years), and in the long-term (more than six years). An emerging theme of the workshop was how the production, conversion, and utilization of biofuels can help increase environmental and economic security locally and globally. Individual papers are processed separately for the data base.

0908 Production

4907 (ETSU-B–1081) **Short rotation forestry for energy: single stem plantations.** Mitchell, C.P. UKAEA Harwell Lab. (UK). Energy Technology Div.; Aberdeen Univ. (UK). 1989. 41p. Available from Available from the British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

One possible type of forest energy plantation is that using single-stemmed trees as opposed to coppice. This type of plantation is suitable for upland and less fertile areas of lowland Britain. They would not compete with coppice energy plantations but rather would complement them. Rotation length will vary according to species, site and energy market. The final dimensions of the required tree will determine the rotation adopted. Rotations of between 10 and 20 years should cover most eventualities. The logistics and costs of establishing single stem forest energy plantations are examined. (author).

4908 (ETSU-B–1171) **Establishment and monitoring of large scale trials of short rotation forestry for energy.** Mitchell, C.P.; Wightman, A.D.; Ford-Robertson, J.B.; Ennion, R. UKAEA Harwell Lab. (UK). Energy Technology Div.; Aberdeen Univ. (UK). 1989. 71p. Available from Available from the British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

A progress report is given on the first three years of field trials on short rotation forestry for use as an energy resource. The trials include coppices of willow and poplar in Southern England, willow coppices in Northern Ireland and Scotland and a screening trial of various species in Southern England. The harvestry and analysis of data from various coppice willow trials near Long Ashton Research Station are also reported. Recommendations are given for economic and effective biomass production. (U.K.).

4909 (SI–1-1989) **Integrated felling in relation to wood chips for fuel and wood for industry.** Kofman, P.D. Skovteknisk Inst., Copenhagen (Denmark). 1989. 36p. (In Danish). Contract EN-3B-069-DK. Available from Available on loan from Risoe Library, DK-4000 Roskilde.

Fejlaftigt ISBN 87798-557.

The aim was to investigate possibilities to increase production of wood chips by utilizing methods of integrating felling of red conifers in relation to this form of fuel and to wood that is to be used in industry. Results showed an increase in the amount of wood chips produced which was also economically satisfactory. Forestry methods, harvesting equipment and economic aspects are examined and described in detail as are also the quality of the resulting wood fuel. The text is illustrated with photographs of equipment, diagrams to show forestry methods and time charts etc. (AB).

0909 Processing

Refer also to citation(s) 5903

4910 (DOE/ER/13875–T1) **Mechanism of formation of the carboxyl of acetate by acetogenic bacteria: Progress report.** Wisconsin Univ., Madison, WI (USA). [1989]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER13875. Order Number DE90003587. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The overall goal of this project is to understand how the carboxyl of acetate is formed by acetogenic bacteria. Our work involves a multidisciplinary approach towards understanding the details of this process which is a key step in the pathway by which anaerobic bacteria synthesize acetyl-CoA. We have used a number of techniques including spectroscopy, enzyme kinetics, electrochemistry, and molecular biology. Figure 1 summarizes our current concept for how this pathway occurs. Our work focuses on carbon monoxide dehydrogenase (CODH). During this year, the sequences of the genes encoding the two subunits of CODH have been determined in a collaboration between labs. Thus, we now know the complete amino acid sequence of CODH. We made major progress in studies of the structure and function of metal centers in the nickel, iron-sulfur protein, CODH. CODH was found to contain one [4Fe-4S] cluster, a [Ni-Fe-C] center, and a [2Fe] center with two oxidation reduction potentials. We postulate that the site for binding CO is a mixed metal center that contains a [4Fe-4S] center bonded to a nickel site by a ligand bridge. One of the metal centers on CODH is the methyl binding site. We discovered that methylation of CODH by the methylated-C/Fe-SP involves reductive activation of a metal center followed by formation of the methyl-metal intermediate. 15 refs., 6 figs.

4911 (DOE-tr–88-23) **Problem of scrapped tires and main activities of Japan Automobile Tire Maintenance Association.** USDOE, Washington, DC (USA). 1988. 37p. Translation source information not available. Sponsored by U.S. DOE Management & Administration. Order Number DE90002696. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper discusses the environmental problems caused by improperly scrapped used tires in Japan and suggests solutions to these problems. Ways in which used tires can be applied to solve other problems are presented. (FSD)

4912 (ETSU-L–25) **Landfill gas exploitation in the UK - an update.** Richards, K.M. UKAEA Harwell Lab. (UK). Energy Technology Div. Jun 1988. 20p. (CONF-8806405–: Seminar on recovery of energy from municipal and industrial waste through combustion, Cambridge (UK), 21-24 Jun 1988). Available from Available from the British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

By the end of 1988 there are likely to exist in the UK some thirty commercial landfill gas recovery and utilisation schemes. Their combined energy savings, through use of gas directly (e.g. in kilns, furnaces and boilers) or indirectly (e.g. in the generation of electricity) will amount to nearly 125,000 tonnes of coal equivalent per annum (tcepa). Expectations for savings might have been even higher, but for the general fall in the price of energy brought about by the collapse in oil prices in 1986. This had the effect of reducing the commercial attractiveness of some direct gas user projects. However, the environmental benefits of using landfill gas in energy schemes has been more than sufficient to underpin interest in this source of 'Renewable Energy'. Energy savings from the use of landfill gas should reach a million tonnes of coal equivalent per annum (Mtcepa) by the mid 1990s, savings worth some $60M or so. By the application of better gas management, recovery and husbandry techniques, the even longer term contribution from the digestion of municipal wastes could exceed 5 Mtcepa. In national, primary energy terms this represents some 1 1/2% of the UK's needs. (author).

4913 (ORF–TE-87-12, pp. 14-28) **Novel biomass-derived ignition improvers for compression ignition alcohol engines.** Hudson, L.R. (New York State Energy Research and Development Authority, Albany, NY (USA)). Ontario Research Foundation, Sheridan Park, ON (Canada). Sep 1987. (CONF-870690–: 3. Windsor workshop on alternative fuels, Windsor (Canada), 24-26 Jun 1987; CE–02782). In *Proceedings of the third Windsor workshop on alternative fuels.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: N/C.

The United States Environmental Protection Agency will require new heavy-duty diesel engines to operate with much lower emissions of particulates beginning in 1991. Methanol is being explored by diesel engine manufacturers as an alternaive fuel to meet this constraint. One of the technical approaches to the use of methanol in diesel engines is the addition of a chemical to improve ignition properties. This allows for methanol use with a minimal adaptation of the engine and, thus with an easy return to petroleum-distillate fuel if desired. Research has been conducted at Pittsburgh University to develop a process for converting low cost biomass to an ignition promoter; this paper describes the results of the first year of research. Samples of whole corn cobs, of various types of lignin, and of peat have been converted into ignition promoters. A test engine was operated successfully at the Ontario Research Foundation using methanol fuel together with these ignition promoters. The chemical and physical properties of the promoters are not given but the economics of these products are discussed in detail; as a preliminary estimate, the promoter would add as little as 5 cents per gallon of finished product. 1 tab.

4914 (STUB–19) **Agitation and scum abatement in bioconversion plants: Technical evaluation of stirring systems.** Carl Bro Gruppen, Glostrup (Denmark). Feb 1984. 30p. (In Danish). Available from Available on loan from Risoe Library, DK-4000 Roskilde.

The aim was to investigate methods for removal of scum in relation to biomass conversion plants, as it can result in operational close-down. Scum formation is related to the plant's design and the

type of manure used, thus the stirring/mixing intensity is often determined by the conditions of the anaerobic bacteria's growth or by requirements regarding heating and heat distribution in the biomass conversion plant. It was concluded that mixing is necessary in the majority of digesting tanks and that those systems which uptil now have utilized open storage tanks can rarely be used effectively. It was shown that electrically driven propeller stirrers and gas injection systems, (especially the latter) were well adapted to the removal of scum in digesting tanks. (AB).

0910 Properties and Composition

4915 (SJF-Beretning–41) **Methods for the determination of the moisture content of straw and investigations related to the storage of straw to be used as fuel for district heating plants.** Thellesen, H.Z. (Statens jordbrugstekniske Forsoeg); Sams, T.; Kirchheiner, H. Statens Jordbrugstekniske Forsoeg, Horsens (Denmark). Jan 1989. 35p. (In Danish). Contract EM-1383/85-8. Available from Available on loan from Risoe Library, DK-4000 Roskilde.

EFP-85.

If the moisture content of straw used as fuel in district heating plants exceeds 18-20%, operation can be interrupted. The heating value is reduced by about 0.3% when the moisture content rises by one unit. During storage straw begins to produce heat when the moisture content exceeds 18-20%. Two of the measuring instruments used were based on the measuring of electric resistance at the point of a 0.50m spear, the third had a 0.19m spear for measuring dielectric capacity. The latter appears to be the most accurate. The investigation has also comprised the development of equipment suitable to be monted on large straw balers, and straw is sufficiently dry. The costs of storage by covering the straw with plastic sheets or tarpaulins, or in barns with walls facing west and south to guard against heavy rain or drift snow, are estimated. It is concluded that the most suitable type of barn for straw storage is the closed barn with a concrete floor, also because damage to this fuel is less likely. The quality of the straw is naturally significant in relation to storage in closed barns. (AB).

0930 Economic, Industrial, and Business Aspects

Refer also to citation(s) 4916

0940 Transport, Handling, and Storage

Refer also to citation(s) 4915

0950 Environmental Aspects

4916 (LBL–27222) **Biomass fuels in the developing countries: An overview.** Meyers, S. (Lawrence Berkeley Lab., CA (USA)); Leach, G. Lawrence Berkeley Lab., CA (USA). Jul 1989. 56p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC03-76SF00098. Order Number DE90002616. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This report presents an overview of what is known about current patterns of biofuels supply and use in the developing countries. We illustrate the diversity of biofuels use, and discuss how use changes with urbanization and commercialization of biofuels. We present information on sources of biofuels, describe the basic technologies employed for using biofuels, and discuss the key factors involved in assessing change in biofuels use over time. We present biofuels consumption data from a number of surveys, and discuss the main factors that shape the level of use of different biofuels. We discuss the responses of rural people to the increasing fuelwood scarcity that is occurring in many parts of the developing world. We describe the transition from biofuels to modern fuels that occurs in cities, and discuss the factors that inhibit this transition. We present estimates of national biofuels consumption for 17 of the largest biofuels-using countries and for larger regions. We discuss the relationship between human use of biofuels and greenhouse gas emissions. Lastly, we present a discussion of policies designed to affect biofuels supply and demand, describing the experience with and prospects for increasing biofuels supply, improving end-use efficiency, and encouraging the transition away from biofuels. 61 refs., 18 tabs.

0980 Waste Management

4917 (EGG-M–89038) **Preliminary design of an improved power generation cycle for municipal waste disposal.** Parks, W.P.; Belovich, V.M.; DeBellis, C.L.; Grant, A.J.; Bielawski, G.T.; Meyer, B.J.; Gibbs, D.R. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1989]. 5p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570. (CONF-891208–22: Winter annual meeting of the American Society of Mechanical Engineers, San Francisco, CA (USA), 10-15 Dec 1989). Order Number DE90002084. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The proposed system defines a combined gas turbine/steam turbine cycle which provides significantly higher efficiency over current refuse boiler systems for municipal waste incineration. A typical refuse plant with resource recovery can produce 4.4 net kJ/kg of refuse burned. The proposed cycle would produce 5.8 net kJ/kg. The key to the proposed cycle is the development of a ceramic composite based heat exchanger capable of operating with 1260 C flue gas inlet temperatures and producing 1075 C outlet air temperatures. This will require the use of ceramic composites, which today show good resistance to refuse corrosive species, have good strength, have low permeability and non-brittle failure which provides toughness and design reliability over conventional brittle ceramics. However, further development and characterization work is needed for utilization in the HiPHES application. Current assessment indicates that, except for the ceramic heat exchanger, other components are commercially available or under development in other programs. The B & W boiler would be a variation of a current design. 5 refs., 3 figs., 2 tabs.

0990 Products and By-Products

4918 (CFS/HQ–89-03061, pp. 187-262) **Research on development of nursery practices and techniques for the establishment and management of fuelwood plantations, including water harvesting and distribution.** Carlson, L.W. (Canadian Forestry Service (Canada)); Shea, K.R. Canadian Forestry Service, Hull, PQ (Canada). Aug 1986. (CONF-8601155–: International Union of Forestry Research (IUFRO) research planning workshop for Africa Sahelian and North Sahelian zones, Nairobi (Kenya), 9-15 Jan 1986; MICROLOG–89-03061). In *Increasing productivity of multipurpose lands.* Available from PC Canadian Forestry Service, Government of Canada, 351 St. Joseph Boulevard, Hull, PQ, CAN K1A 1G5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

Overuse of natural vegetation to supply fuelwood is one of the main causes of environmental degradation in dry tropical Africa. On the basis of forecasts of future populations and energy policies, the dependency on fuelwood is expected to remain high for a long time. Attempts to combat this phenomenon, and desertification in general, have not so far been spectacularly successful. Planting trees, which is one solution suggested to solve the problem, has limitations that are not all of a technical kind. A review is presented of the fuelwood problem in a number of West African countries, and their experience with fuelwood plantations and other possible solutions to the problem. Research needs (choice of plantation site, suitable species, silvicultural techniques) are identified. Eight preliminary research and development projects are proposed, relating to projects intended to raise the general level of knowledge and improve information dissemination, evaluation of existing techniques and practices, and strictly technical projects concerning nursery techniques and plantation techniques. 37 refs., 8 tabs.

4919 (QMA–89-02875) **Farm manure. Production.** Quebec Ministere de l'Agriculture, des Pecheries et de l'Aminentation, Ste-Foy, PQ (Canada). Sep 1988. 4p. (MICROLOG–89-02875). Available from PC Quebec (Province). Ministere de l'agriculture, des pecheries et de l'alimentation, 200A, chemin Ste-Foy, Quebec, PQ, CAN G1R 4X6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $2.00 CAN; MF $10 CAN.

Detailed data are presented on manure production from farm animals found in Quebec. Information on solid and liquid manures is

provided for various classes of animals and of different sizes within classes, including volume produced, water content, and amount of litter required. Animals covered in this report include cattle, pigs, poultry, sheep, horses, furbearing animals, and rabbits. 4 tabs.

4920 (STUB–34) **Reduction of hydrogen sulphide in methane using filter with iron filings.** Oestergaard, N. Teknologisk Inst., Taastrup (Denmark). Kemiteknik. [1986]. vp. (In Danish). Order Number DE90719281. Available from V/MF A01.

Biogas contains hydrogen sulphide produced by the breakdown of the amino acids cysteine and methionine contained in the proteins which are found in biological tissue and excretion products. It can also be produced by the reduction of sulphates if they are found in sufficient concentration. Under the process of anaerobic digestion, carbon dioxide, methane and hydrogen sulphide are produced. CO2 and CH4 are produced by methane bacteria and H2S by sulphyr bacteria. As sulphur bacteria absorb hydrogen more easily than methane bacteria, hydrogen sulphide will always be produced in the process of methane production from biological materials. The concentrations of H2S in relation to the composition of the biomass and to the maximum allowed amount are given. In order to reduce the content of H2S it is suggested that iron filings could be used. Oxidised iron functions as a catalyst for the oxidation of H2S to isolated sulphur, S8, under the reduction process of ferric iron, Fe+3, to ferrous iron, Fe+2. This method is cheaper than that where bog iron ore is utilized. Test methods and current results are described. Experiments are still in process and further results will be published later. (AB).

10 SYNTHETIC FUELS

Refer also to citation(s) 5389

1002 Production

Refer also to citation(s) 4558

4921 (DOE/PC/90014–T4) **Upgrading of light Fischer-Tropsch products: Quarterly report No. 8, July 1, 1988–September 30, 1988.** UOP, Inc., Des Plaines, IL (USA). 11 Jul 1989. 40p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-86PC90014. Order Number DE90003031. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Work during this quarter concentrated on Task 4 of the study. The objective of this task is to evaluate the application of the UOP/BP Cyclar* process to the upgrading of Fischer-Tropsch LPG products into aromatics. Results from pilot plant studies were translated into commercial yield estimates as described in Quarterly Report No. 7. This quarterly report documents an economic evaluation of the Cyclar process for converting LPG into aromatics in a Fischer-Tropsch upgrading complex. 1 ref., 11 figs., 9 tabs.

4922 (DOE/PC/90014–T5) **Upgrading of light Fischer-Tropsch products: Quarterly report No. 9, October 1, 1988–December 31, 1988.** UOP, Inc., Des Plaines, IL (USA). 11 Jul 1989. 4p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-86PC90014. Order Number DE90003030. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Work during this quarter concentrated on writing the Topical report documenting Task 4 of the study. The objective of this task is to evaluate the application of the UOP/BP Cyclar* process to the upgrading of Fischer-Tropsch LPG products into aromatics. Conclusions about pilot plant testing or Cyclar economics have been made in previous quarterly reports. This report contains a comment about how Indirect Cyclar could be applied in high olefin situations as well as a general conclusion about Cyclar in a Fischer-Tropsch upgrading complex. 1 tab.

1007 Economic, Industrial, and Business Aspects

Refer also to citation(s) 4921, 4922

13 HYDRO ENERGY

1301 Resources and Availability

4923 (CE/IWD–89-03831) **Quebec historical water levels summary, to 1987.** Environment Canada, Ottawa, ON (Canada). Inland Waters Directorate. 1989. 237p. (In English and French). (MICROLOG–89-03831). Available from PC Water Survey of Canada, Place Vincent Massey, 351 St. Joseph Blvd., Ottawa, ON, CAN K1A 0E7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

A summary is presented of monthly and annual mean water level, and annual extremes of water levels, for lakes and rivers in Quebec. Historical data extend as far back as the early 1900s, having been collected by various provincial and federal agencies and organizations, including Hydro-Quebec. Descriptive information about the gauging stations is also included, such as location, type of gauge, drainage area, and whether the flow is natural or regulated.

4924 (ETSU-SSH–4063-P3) **Small scale hydroelectric generation potential in the UK. V. 3: Rejected sites.** UKAEA Harwell Lab. (UK). Energy Technology Div. 1989. 52p. Available from Available from the British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

During the period May 1987 to October 1988, Salford University Civil Engineering Limited undertook an appraisal of the economic potential for small-scale hydro-electric generation in the U.K. The Main Report of this study, Volume I, contained details of the scope and terms of reference for the study, methods of appraisal, results and conclusions thereon. Volume II of the report contained data for each of the sites considered in detail in the study. During survey visits and subsequently at the office appraisal stage, a large number of possible sites were rejected from the survey. A listing of these sites together with reasons for their rejection is contained here as Volume III of the report. (author).

1305 Economic, Industrial and Business Aspects

Refer also to citation(s) 5230, 5231, 5278

1306 Environmental Aspects

Refer also to citation(s) 5240

14 SOLAR ENERGY

1401 Resources and Availability

Refer also to citation(s) 5310

4925 (CONF-8811198–, pp. 317-331) **Solar energy and daylighting availability for bioclimatic buildings: Two simple graphical calculation methods.** Rossi, G. (Venice Univ. (Italy). Dipt. di Progettazione Architettonica); Vio, M. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and appliccations in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Available from NTIS (US Sales Only), PC A19.

The graphical method for the calculation of daylight illumination was based on an analytic expression which defines, at a point in a horizontal plane, the direct factor as a function of azimuth angles and elevation angles subtended by the point itself and the outer limits of the source. This analytical approach permitted the tracing of a family of curves with which an immediate evaluation of daylighting is possible when the two sets of angles are known. The graphical method for the calculation of direct solar radiation is based on well

known geometrical relationships which describe reciprocal earth-sun positions and the equations expressing the component of direct solar radiation as a function of the angles that are characteristic of the positions of the sun and the orientation of the design environment. Not intended for analyses involving many different environments and long time durations, these graphical methods give quick and rapid indications in analyses made on few local samples or in cases in which it is necessary to accurately compare different solutions.

1404 Environmental Aspects

4926 Hazard characterization and management of tetramethyl tin in the production of photovoltaic cell transparent conductive oxide layers. Kalb, P.D. (Brookhaven National Lab., Upton, NY (USA). Biomedical and Environmental Assessment Div.); Moskowitz, P.D. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). DOE Contract AC02-76CH00016. (CONF-880965–: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

Tetramethyl tin (TMT) has been used by the photovoltaics industry to prepare transparent conductive oxide films on glass. Significant health hazards, however may be associated with the use of TMT. Short-term exposures to TMT vapors in excess of accepted exposure limits can produce a range of physiological symptoms. Although less is known about the hazards from prolonged exposure to low levels of TMT, some studies suggest that effects are both cumulative and persistent. TMT also is highly flammable and emits toxic fumes on decomposition. In an occupational setting, workers may be routinely or accidentally exposed to TMT liquids or vapors. Approaches for controlling these occupational hazards are described. Analysis suggests that routine emissions from large scale manufacturing facilities using TMT will need to be reduced by approximately 90% to comply with toxic gas containment guidelines to protect public health.

1405 Solar Energy Conversion

Refer also to citation(s) 5285, 5457

4927 (AD-A–211332/2/XAB) **Chemical approaches to artificial photosynthesis.** Meyer, T.J. North Carolina Univ., Chapel Hill, NC (USA). Dept. of Chemistry. May 1989. 10p. Available from NTIS, PC A02/MF A01.

Pub. in Accounts of Chemical Research, Vol. 22, No. 5, 163-170(May 1989).

In artificial photosynthesis, the goal is to mimic the ability of green plants and other photosynthetic organisms in their use of sunlight to make high-energy chemicals. This is a difficult problem chemically, which accounts for much of the complexity of the natural photosynthetic apparatus. Nonetheless, a number of promising approaches appeared in recent years based on semiconductors, membranes, vesicles, and molecular system. The chemical approaches to artificial photosynthesis are based on a series of well-established chemical principles, the development of an extensive supporting synthetic chemistry, and the discovery of new catalytic systems and the principles by which they operate. It is impressive that nearly all of the background chemistry and photochemistry has appeared within the last 10-15 years. It seems inevitable that, with continued progress in this area, devices of the type implied here, or at least having some of their features, will be successfully constructed. Even if they have no economic value, the ability to incorporate the broadly based set of ideas required to deal with making them will be impressive demonstration of the growing high technology capabilities of modern chemistry.

4928 (AD-A–211537/6/XAB) **Graded band-gap solar cells. Final report, 1 September 1984-30 September 1988.** Olsen, L.C. Washington Univ., Seattle, WA (USA). Jun 1989. 41p. Available from NTIS, PC A03/MF A01.

The program has emphasized investigations of graded band-gap solar cells. The key objective was to determine the feasibility of obtaining high efficiencies with a graded-emitter heterojunction structure. The Al(x)Ga(1-x)As ternary system was selected for actual device fabrication and characterization. Interpretation of photoresponse data for graded devices indicated that the minority-carrier diffusion length was essentially zero for x equal to or greater than .25. This property of the AlGaAs films made it impossible to obtain the expected photocurrent from the graded devices. However, studies were carried out that clearly indicated that the structures with graded emitters were characterized by an enhanced photoresponse relative to homojunction devices.

4929 (DOE/ER/13506–24) **Photochemical solar energy conversion utilizing semiconductors localized in membrane mimetic systems.** Fendler, J.H.; Baral, S. Syracuse Univ., NY (USA). Dept. of Chemistry. [1989]. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER13506. (CONF-8906129–2: 13. DOE solar photochemistry conference, Silvercreek, CO (USA), 11-15 Jun 1989). Order Number DE90003450. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Different membrane mimetic systems continue to be exploited as media for organizing components of the artificial photosynthetic apparatus. Surfactant vesicles, polymerized surfactant vesicles, bilayer lipid membranes (BLMs), and Langmuir-Blodgett (LB) films are used as membrane mimetic systems. Catalyst-coated colloidal semiconductor particles are employed as sensitizers and relays in sacrificial half cells. Emphasis in our studies is placed on obtaining fundamental information on photoelectron transport. BLM-supported colloidal semiconductors provide the most suitable media since photoelectron transfer processes can be monitored by simultaneous electrical and spectroscopic measurements. Advantage is taken of the insight gained from mechanistic investigations of vesicles and BLMs in the construction of more elaborate semiconductor-particle-containing LB films.

4930 (N–89-27868) **Indium phosphide solar cell research in the US: Comparison with nonphotovoltaic sources.** Weinberg, I.; Swartz, C.K.; Hart, R.E. Jr. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. 13p. (NASA-TM–102103;E–4869;NAS–1.15:102103;CONF-8910243–: European space power conference, Madrid (Spain), 2-6 Oct 1989). Available from NTIS, PC A03/MF A01.

Highlights of the InP solar cell research program are presented. Homojunction cells with AMO efficiences approaching 19 percent were demonstrated while 17 percent was achieved for indium tin oxide (ITO)/InP cells. The superior radiation resistance of these latter two cell configurations over both Si and GaAs were demonstrated. InP cells on board the LIPS III satellite show no degradation after more than a year in orbit. Computer modeling calculations were directed toward radiation damage predictions and the specification of concentrator cell parameters. Computed array specific powers, for a specific orbit, are used to compare the performance of an InP solar cell array to solar dynamic and nuclear systems.

4931 (SERI/PR–213-3590) **Photovoltaic Measurements and Performance Branch, annual report, FY 1988.** Abou-Elfotouh, F.A.; Dippo, P. (eds.). Solar Energy Research Inst., Golden, CO (USA). Jan 1989. 153p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89009500. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

The Photovoltaic (PV) Measurements and Performance Branch of the Solar Energy Research Institute (SERI) provides extensive PV materials, device, and component characterization, measurement, fabrication, and modeling research and support for the international PV research community in the context of the US Department of Energy's PV Research Program goals. This report summarizes the Branch's progress from 1 October 1987 through 1 October 1988. The five technical sections present a succinct overview of the capabilities and accomplishments of the various research groups in the branch, namely, Surface and Interface Analysis, Materials Characterization, Device Modeling and Fabrication, Cell Performance and Electro-Optical Characterization, and Advanced Module Testing and Performance. The report highlights the main research project completed in FY 1988 including measurements in more than 80 branch-originated journal and conference publications, in collaboration with, or in support of, about 130 university, industrial, government, and in-house research groups. 85 refs.

4932 Results of the SERI multijunction device efficiency measurement task force. Hulstrom, R.L. (Solar Energy Research Inst., Golden, CO (USA)); Ohi, J.M. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965–: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

This paper presents the results of the SERI Multijunction Device Efficiency Measurement Task Force. Task force recommendations are given regarding device definitions, standard reporting conditions, device area definitions, indoor measurements, reference cells, outdoor measurements, intercomparisons, and other pertinent subjects. Because there was not always total agreement, the reported recommendations do not necessarily represent the formal position of individual task force members, companies, or agencies.

4933 Present status of the development of thin-film solar cells. Dhere, N.G. (Solar Energy Research Inst., Golden, CO (USA)). *Vacuum (UK)*, 39(7-8): 743-748 (1989).

The principle types of thin-film solar cells are based on single-junction and multi-junction hydrogenated amorphous silicon (a-Si:H), copper indium diselenide ($CuInSe_2$) and cadmium telluride (CdTe). Impressive gains in the performance of these cells have been reported in recent months. The problem of contacts to CdTe cells has been circumvented, resulting in the development of stable 11% efficient n-CdS/i-CdTe/p-ZnTe heterostructure solar cells. Total small-area (1 cm^2) efficiencies which have been measured at SERI under standard conditions (global AM 1.5) are as follows: single-junction a-Si:h, 11.5-12%; triple-junction a-Si:H:F, 12.4% (active area 13.3%); $CuGaInSe_2$, 14.1% (active area); CdTe, 10-11%; and $CuInSe_2$-a-Si:H cascade cells, 14.6%. Hydrogenated amorphous silicon solar-cell panels are being commercialized in several countries. Small-scale production of CdTe panels has also been undertaken. Recently, a $CuInSe_2$ module with the world's highest thin-film module efficiency, 11.1% , an aperture area of 938 cm^2 and a total power of 10.4 W, has been tested at SERI. (author).

1407 Solar Thermal Power Systems

4934 Evaluation of the SOLAR ONE and CESA-I experimental receiver and storage systems. Castro, M. (Electronic Engineering Dept., Escuela Tecnica Superior de Ingenieros Industriales, c/ Jose Gutierrez Abascal, 2. 28006 Madrid (ES)); Presa, J.L.; Peire, J.; Baker, A.; Faas, S.; Skinrood, A.C. vp of The 8th Miami international conference on alternative energy sources. Volume 1-2 (Condensed Papers). Vezioglu, T.N. Clean Energy Research Inst. University of Miami, Coral Gables, FL (1988). (CONF-871204–: 8. Miami international conference on alternative energy sources, Miami Beach, FL (USA), 14-16 Dec 1987).

The Joint Evaluation Project of the SOLAR ONE (Barstow, California, U.S.A.) and CESA-I (Almeria, SPAIN) Receiver and Storage Systems is sponsored by the U.S. - Spain Joint Committee and is carried out in America for the S.N.L. Livermore, and in Spain for the Electronic Engineering Department, Polythecnic University, Madrid. The evaluation of these subsystems is accomplished in a parallel way by means of similar test plans on both plants, allowing to obtain comparable results. This comparative study between the Receiver systems of both plants, one of open type and the other of cavity type, and between the storage systems, one or two tanks respectively, allows comparison of their performance, efficiency and features. Thus, the design type more suitable in the future to meet the requirements of these solar plant subsystems can be defined.

1408 Ocean Energy Systems

4935 (SERI/SP–220-3024) **Ocean Thermal Energy Conversion: An overview.** Solar Energy Research Inst., Golden, CO (USA). Nov 1989. 36p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89000838. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Ocean thermal energy conversion, or OTEC is a technology that extracts power from the ocean's natural thermal gradient. This technology is being pursued by researchers from many nations; in the United States, OTEC research is funded by the US Department of Energy's Ocean Energy Technology program. The program's goal is to develop the technology so that industry can make a competent assessment of its potential – either as an alternative or as a supplement to conventional energy sources. Federally funded research in components and systems will help OTEC to the threshold of commercialization. This publication provides an overview of the OTEC technology. 47 refs., 25 figs.

1409 Solar Thermal Utilization

Refer also to citation(s) 4925, 5255, 5256, 5307, 5308, 5313

4936 (CONF-8811198–) **Bioclimatic architecture, energy conservation and environmental quality. Prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.** International Solar Energy Society (ISES), Rome (Italy). Italian Section; Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica. Feb 1989. 445p. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. Order Number DE90724628. Available from NTIS (US Sales Only), PC A19.

Within the context of energy conservation and environmental quality, this convention dealt entirely with solar building architectural systems - new design (system and equipment) and design techniques, monitoring and comparative evaluation of efficiencies, cost benefit analyses, feasibilty studies, specialized computer codes, pilot projects, research programs (and commercialization of technological innovations), Italian Government promotional efforts (legal and financial incentives), and international normatives.

4937 (CONF-8811198–, pp. 19-31) **Bio-climatic buildings in Italy: Design/construction monitoring.** Citterio, M. (ENEA, Casaccia (Italy). Dipt. Fonti Alternative e Risparmio Energetico); Messina, M.G.; Cesaroni, C. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy consumption and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Order Number DE90724628. Available from NTIS (US Sales Only), PC A19.

This report outlines the key phases of a plan developed to monitor the efficacy of the design and construction of bio-climatic buildings constructed in Latisana (Udine), Italy. The project centered around the construction of a 4 storey (56 units) residential building in which different combinations of passive solar architectural systems were incorporated - direct gain, attached greenhouses and Trombe walls. An active system, wind and solar assisted heat pump, was chosen for a vertical column of 4 units. Another 71 unit building received a centralized solar hot water heating system. All the designs were experimental and formed part of a Government energy consevation program involving legal incentives and financial/technical assistance for the utilization of solar energy technology in building construction. Since the monitoring effort began in 1988, only preliminary results are available. Basically it involves the verification and comparison of energy consumptions for the various residential units incorporating a variety of solar architecture solutions.

4938 (CONF-8811198–, pp. 75-91) **Bio-climatic residential building technology in Italy: Demonstration programs, proposal for increased application.** Pistone, G. (AGIP Petroli SpA, Milan (Italy). Direzione Ricerca e Sviluppo); Pinzuti, M. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality:*

prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988. Order Number DE90724628. Available from NTIS (US Sales Only), PC A19.

Solar architecture demonstration programs are being conducted by AGIP Petroli SpA (Italy) and center around the minimization of building energy consumption by the optimal choice (taking into account cost/benefits) and implementation of passive solar systems, i.e. Trombe walls, attached greenhouses, etc. An analysis of past results based on a sample of 50 residential buildings (1000 units) has led to a demonstration project involving the design and construction of a complex of three residential buildings (102 units) in Prato, Italy. In addition, to outlining the knowledge gained through the analysis of the collected data, this report indicates how passive solar system technology was applied in the design of these three buildings and provides an assessment of unit costs. Suggestions are made for the increased diffusion of this technology throughout Italy, and these basically involve the strengthening of the existing building code to take into consideration new available technology and thus mandate stricter limits on building energy consumption and construction costs.

4939 (CONF-8811198–, pp. 47-73) **Bio-climatic building technology: An example of a solar building at Ispra, Italy.** Rizzi, G. (ENEA, Ispra (Italy)); Scudo, G. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Order Number DE90724628. Available from NTIS (US Sales Only), PC A19.

Design notes are provided on a demonstration building in which a variety of passive solar systems were incorporated - solar ponds, solar chimneys, double envelope construction and daily and seasonally regulated air intakes. With regard to space heating, this report describes how the building's heat is received, accumulated, distributed and regulated. The choice of building materials and assembly sequence are also noted and an analysis is made of the economics of the design (cost/benefits, payback period). The building, to be used by ENEA (Italian Commission for Alternative Energy Sources) as a research facility, is situated in a temperate continental climate where the average winter solar radiation is expected to be 8.400 KJ per square meter on horizontal surfaces.

4940 (CONF-8811198–, pp. 109-132) **Energy saving interventions at a public school in Italy (solar architecture applications).** Cesarano, A. (Naples Univ. (Italy)); De Rossi, F.; Sibilio, S.; Vanoli, R. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Order Number DE90724628. Available from NTIS (US Sales Only), PC A19.

This paper reports on a modular solar wall unit integrated into the architectural design of a school in Naples, Italy. It basically consists of a glazed external surface, 10 cm (approx.) behind which lies an insulated glazed sandwich panel which absorbs incident solar radiation ducts at the top and bottom of this double wall construction allow the circulation of air by a chimney effect. The overall building design stresses the effective integration of solar systems and traditional HVAC systems. In addition, control of heat dispersion is assured by the optimum choice of transparent and absorbent double glazing, heat recovery equipment and space heating system (set of heat pumps with motor run by methane). The design should allow a coefficient of dispersion of 0.37W/cubic meter K, whereas the national building code requires 0.71W/cubic meter K. the overall energy savings are estimated at about 60%. Results of tests on prototypes of these wall systems supplement this paper.

4941 (CONF-8811198–, pp. 133-142) **Solar architecture: Monitoring demonstration buildings in Piemonte (Italy).** Pagani, R. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in rome (Italy), 9-10 November 1988.* Order Number DE90724628. Available from NTIS (US Sales Only), PC A19.

Seventeen apartement buildings had a variety of solar architectural systems - Trombe walls, attached greenhouses, solar air heaters, etc., incorporated into their design. Built in northern Italy (Piemonte), these buildings were then monitored to check the performance and reliability of the solar systems and thermal insulation. The monitoring data was graphically represented in three sets on information - on/off (fraction of time in which space heating equipment was in operation); indoor and outdoor hourly temperatures; collector (solar air) inlet and outlet temperatures; average daily energy exchangers per cubic meter of heated building volume (boiler/radiators, boiler/recharge air, solar energy/ambient air, thermal energy at heat recovery intake, thermal energy lost at heat recovery outlet). Cost of conserved energy and economic efficiency were then assessed (and compared for the different designs). The energy efficiencies of 13 out of the 17 buildings exceeded the standards set by the Italian building code.

4942 (CONF-8811198–, pp. 155-161) **Use of solar architecture in school buildings (Bologna, Italy).** Gualdi, F. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Order Number DE90724628. Available from NTIS (US Sales Only), PC A19.

The report describes two solar architectural systems employed in a high school in Bologna (northern Italy). The external walls of the school are equipped with an enclosed system of manually operated steel louvres (which can be oriented 360 degrees) mounted behind a glazed curtain wall. The winter surface of the steel blades is prepared in such a way as to have a high absorption coefficient (0.8), while the summer surface value is (0.3). In the winter, the temperature of heated air is varied by the suitable orientation of the blades and the air is circulated into the classrooms by a thermostat regulated ventilator. In the winter, solar radiation is reflected by the lighter side of the blades and excess heat is vented into the external environment. The methane central heating system is supplemented by a battery of solar air heaters mounted on the southern face of the building's roof. It is estimated that the combined solar systems are producing a net saving of 30% in heating costs.

4943 (CONF-8811198–, pp. 163-175) **Residential buildings: Low energy consumption Italian design.** Esposito, V. (A.T.E.R., Florence (Italy)); Roda, R. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.*

Order Number DE90724628. Available from NTIS (US Sales Only), PC A19.

This report describes ongoing activities at Azienda Territoriale Edilizia Residenziale (Italy), a consulting firm which specializes in optimizing the energy efficiency of buildings such as to obtain high levels of living comfort with contained energy consumption levels. Not only are building designs optimized by the efficacious use of solar architecture, but also the choice of construction techniques and building materials (functionality, wear resistance and ease of maintenance). This report outlines how the above considerations were implemented in the design of 102 residential units for the Comune di Prato, Italy.

4944 (CONF-8811198–, pp. 185-208) **Bioclimatic architecture in Italy: Technology assessment - problems, possibilities.** Dusi, G.B. (ENEA, Casaccia (Italy). Dipt. Fonti Alternative e Risparmio Energetico); Michelini, M. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Available from NTIS (US Sales Only), PC A19.

An assessment is made of collected data on regional climate variations from northern to southern Italy in order to determine critical design criteria for space heating and cooling systems for residential buildings. Hypothetical designs are then evaluated for possible energy savings that can be acquired through the judicious use of passive solar systems and thermal insulation. Results are compared with standards set by Italian building codes. An analysis is then made of the problems, constraints and economics associated with the retrofitting of traditional space heating systems to include solar technology.

4945 (CONF-8811198–, pp. 143-153) **Bioclimatic architecture and energy conservation: Conphoebus (Italy) consulting activities.** Sciuto, S. (Conphoebus Scrl, Catania (Italy)). Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Order Number DE90724628. Available from NTIS (US Sales Only), PC A19.

A brief outline is given of some of the key projects undertaken by the Italian bioclimatic building design consultants, Conphoebus. Centered around the exploitation of renewable energy sources, the projects included a design feasibility study for a 30.000 square meter research building located in Egypt and which required protection against summer insolation and the use of natural cooling sources offered by noctural heat travel and subsoil heat transfer and an analysis of passive heating and cooling systems for a low cost residential area located in Jamaica and which required highly intensive enegy savings solutions.

4946 (CONF-8811198–, pp. 217-234) **The Barra passive solar system: Combined solar architecture and photovoltaic conversion technologies.** Campanile, M. (Calabria Univ, Arcavacata di Rende (Italy). Dipt. di Fisica); Franceschi, L.; Nicoletti, A.; Piccione, B.; Zito, A. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and application in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Available from NTIS (US Sales Only), PC A19.

The paper presents brief design notes on an Italian designed solar chimney system which can operate with heat absorption panels consisting of an array of photovoltaic cells mounted in such a way as to form a sort of Venetian blind configuration. The combination of the two technologies is described as a 'total energy' system providing energy for heating, ventilation, dehumidification and powering of electrical fixtures in residential homes and small commercial buildings. Results of performance analyses on demonstration units employing the solar chimney system (without photovoltaic panels), which can be used for both space heating and cooling, are tabled. Sketches are provided of a typical building cross section to indicate the location of thermal insulation, under ceiling air passages and directions of summer and winter air flows.

4947 (CONF-8811198–, pp. 235-242) **Bioclimatic architecture and urban planning.** Bacigalupi, V. (Rome Univ. 'La Sapienza' (Italy). Dipt. di Disegno Industriale e Produzione Edilizia). Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Order Number DE90724628. Available from NTIS (US Sales Only), PC A20/MF A01.

Key elements of bio-climatic architecture as it relates to residential area planning are identified and brief design notes are offered. The points examined are: selectioning of expansion zones; building typology; determination, for a given building volume, of possible areas for solar architecture applications; the impact of solar architectural systems upon permissible building volume; civil building code (Italian) limitations; ratio between window and floor area. The differences in the approaches to master urban plans and plans for individual zones are noted. Comments are also made on the incorporation of direct sunlight access rights into existing building codes.

4948 (CONF-8811198–, pp. 243-249) **Bio-climatic architecture and building materials.** Lannutti, C. (Rome Univ. 'La Sapienza' (Italy). Dipt. di Disegno Industriale e Produzione Edilizia). Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental qulity: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 19898.* Order Number DE90724628. Available from NTIS (US Sales Only), PC A20/MF A01.

In a survey conducted in Italy on bio-climatic building materials, it was found that good quality materials for thermal insulation are readily available; solar water heating equipment, despite high costs, shows some promise in certain climatic zones. A lot of research is necessary for the improvement of passive solar systems and material so that they can better integrate with overall building construction methodology and architectural design and that they create fewer maintenance problems with respect to adjustments for seasonal variations.

4949 (CONF-8811198–, pp. 251-262) **Low energy consumption building construction: Planning.** Roda, R. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic achitecture, energy conservation and environmental quality: prosepctives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in*

Rome (Italy), 9-10 November 1988. Available from NTIS (US Sales Only), PC A19.

An Italian national survey of government assisted solar architecture interventions (relevant to either new construction or retrofitting) indicates that passive systems have: effectively reduced fuel consumption for space heating; added greatly to overall material construction costs; neither causer summer cooling problems nor reduced living comfort; created some operating and maintenance probelms, particularly in areas with strong seasonal variations in climate. This paper calls for the incorporation of acquired knowledge on solar architecture technology and construction techniques into guidelines for future government programs. In particular, more precise design and construction standards and cost controlguides are to be included and standardized methodologies for technical-economical verifications are to be established.

4950 (CONF-8811198–, pp. 285-291) **Bio-climatic building design codes (recommendations for program optimization).** Malosti, M. (ENEA, Casaccia (Italy). Dipt. Fonti Alternative Rinnovabili e Risparmio Energetico). Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Order Number DE90724628. Available from NTIS (US Sales Only), PC A19.

Through an analysis of current practices and past experience in solar architectural design in Italy, this report indicates the need for improved computer programs for the design of bio-climatic buildings. Some of the difficulties noted with current codes are: scarse level of detail for industrial purposes, operator training problems, data reliability, complexity and limited adaptability to innovative components. Additional local problems in Italy include the lack of detailed and consistent weather data and the presence of historical buildings with uncommon architectural forms. The development of more simplified and flexible codes is therefore recommended.

4951 (CONF-8811198–, pp. 293-299) **Passive solar heating conservation guidelines for Italy.** Jones, R.W. (Los Alamos National Lab., NM (USA)). Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental qualityL: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meetiang held in Rome (Italy), 9-10 Nov 1988.* Available from NTIS (US Sales Only), PC A19.

The objectives of passive solar heating design are comfort and economy. Widespread success in meeting these aims requires simple guidelines that can be used at an early stage of design. Such guidelines must be based on specific climate and cost information. Thermal criteria for comfort include design targets for mean room temperature and maximum diurnal temperature swing. Economic criteria include a minimum life-cycle cost of passive solar aperture, conservation, and heating energy. The most fundamental guidelines assist in the selection of passive solar aperture area and envelope conservation levels at an early design stage. Such guidelines should be expressed in a way that they may be applied in early schematic design before extensive detail is available on the building form and specifications. This paper presents a set of such guidelines based on a minimum life-cycle cost. Results are given for a particular set of cost assumptions, for 28 locations in Italy.

4952 (CONF-8811198–, pp. 279-284) **Solar village in Pecs, Hungary (solar architecture).** Mastroianni, M.; Lazzareschi Belloni, C. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Order Number DE90724628. Available from NTIS (US Sales Only), PC A19.

Basically four story terraced structures (attached greenhouses facing south, no windows on east and west sides), the residential buildings of this 'solar village' incorporate the following solar systems: Trombe walls (to preheat ambient ambient air in the winter and domestic hot water in the summer), attached greenhouses, solar water heaters and heat absorbing masonry. Circulation of air is by natural convection and by fans. Glazing can be darkened to reflect sunlight during summer. Heat storage is also provided by an accumulation tank of water immersed grovel located in the underground services area. The architectural design allows the use of many prefabricated modular components thermally insulated sandwich walls are used for the northern facade.

4953 (ENEA-RT-FARE–88-24) **Design, development and experimental evaluation of solar collector with storage space heating system for school building at Civiglio (Como, Italy).** De Giorgi, G.; Fumagalli, s.; Frascone, A.; Soma, L.; Esposito, L.; Bhargava, A.K.; Sharma, V.K. ENEA, Casaccia (Italy). Dipt. Fonti Alternative Rinnovabili e Risparmio Energetico. Nov 1988. 56p. Order Number DE90724613. Available from NTIS (US Sales Only), PC A04.

This report aims at investigating means for space heating using processes suitable for implementation in areas where the conventional energy resources are scarse. Bearing in mind the low cost of capital investment and utilization possibilities, mainly space heating, we have designed and fabricated a simple solar collector - storage system. The categorical objectives of this report are: exploring the possibility of using different materials for the insulated base, the trasparent coverings, the collecting plate, box structure, potential candidates for sensible heat storage, etc.; to design a suitable medium capacity solar collector - storage unit; to discuss the constructional features of the system under investigation. Experiments have also been performed on such a system fabricated and installed at Civiglio (Italy). Experimental observations of fluid temperature, energy storage, the heat decay characteristics of the storage bed under different climatic condition and other measures of system performance are also repoerted in detail. In addition to the experimental results, the operation schedule of system, temperature control sequence used and suggestions for further improvements are also reported in the present report.

4954 (SAND–89-0246C) **Analysis of catalytically enhanced solar absorption chemical reactors: 1, Numerical model description.** Hogan, R.E. Jr. (Sandia National Labs., Albuquerque, NM (USA)); Skocypec, R.D. Sandia National Labs., Albuquerque, NM (USA). [1989]. 16p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. (CONF-891208–4: Winter annual meeting of the American Society of Mechanical Engineers, San Francisco, CA (USA), 10-15 Dec 1989). Order Number DE89014742. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A detailed numerical model is presented for the Catalytically Enhanced Solar Absorption Receiver (CAESAR). CAESAR is a high-temperature chemical reactor for the carbon dioxide reforming of methane. Concentrated solar energy is volumetrically absorbed throughout a porous absorber matrix impregnated with a rhodium catalyst. The catalyst promotes heterogeneous reactions with fluid-phase reactant species flowing through the absorber. The numerical model has been developed to provide guidance in the catalytic matrix design for CAESAR, to evaluate the reactor performance, and to evaluate test data. There are a number of applications of this concept, including thermochemical energy transport, methanol production, and the destruction of certain classes of hazardous chemical waste. 13 refs., 5 figs.

4955 (SAND–89-0247C) **Analysis of catalytically enhanced solar absorption chemical reactors: 2, Predicted characteristics of a 100 kWsub chemical reactor.** Skocypec, R.D.; Hogan, R.E. Jr. Sandia National Labs., Albuquerque, NM (USA). 1989. 22p.

Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. (CONF-891208–5: Winter annual meeting of the American Society of Mechanical Engineers, San Francisco, CA (USA), 10-15 Dec 1989). Order Number DE89014743. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The CAtalytically Enhanced Solar Absorption Receiver (CAESAR) volumetrically absorbs concentrated solar energy throughout a catalyzed porous absorber matrix volume, promoting heterogeneous reactions with fluid-phase reactant species flowing through the absorber. There are a number of applications of this concept, including thermochemical energy transport, methanol production, and the destruction of certain classes of hazardous chemical waste. A numerical model of these reactors has been developed to provide guidance in the catalytic matrix design for CAESAR, which is intended for the carbon dioxide reforming of methane. In addition, the model is being used to evaluate both the 100 $kW_{chemical}$ reactor performance and test data. This paper presents the effects on the thermal and chemical characteristics of the reactor of varying the incident solar flux, the fluid mass flow, the convective heat transfer coefficient, the solar and infrared optical thicknesses, and the catalyst loading. Predicted CAESAR performance is based on a prototype absorber and anticipated operating conditions. Model results suggest the mass flux must be proportioned to the incident solar flux radial distribution to prevent unacceptably high local temperatures and to provide a reactor having more uniform exit conditions. Either the catalytic loading or geometric thickness of the absorber should be increased for conversion to approach equilibrium levels. Also, the optical density of the matrix (particularly at the sunlit side of the reactor) should be decreased to distribute solar energy more uniformly in depth and decrease matrix temperatures at the front of the absorber. 14 refs., 13 figs., 3 tabs.

4956 (SERI–9009462) **Bright ideas: Passive solar buildings.** Ridley, L. Solar Energy Research Inst., Golden, CO (USA). Aug 1989. 25p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89009462. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Significant federal involvement in solar building technology began with a series of acts of Congress passed in 1974; the Solar Heating and Cooling Demonstration Act; the Energy Reorganization Act; the Solar Energy Research, Development and Demonstration Act; and the Federal Non-Nuclear Energy Research and Development Act. These acts established programs for solar-related research and development in various fields. In 1977, the Department of Energy Reorganization Act established DOE and placed all solar energy programs under its authority. Over the years, the DOE Solar Buildings Technology Program has developed in response to the needs of the building industry and to opportunities opened up by new technology. From 1974 to 1980, a wide range of federal solar activities existed, including scientific research on many different fronts, demonstration projects, market research, design assistance, community programs, professional education, and public information. Since 1980, a smaller federal solar research and development program has emphasized new technology. The Solar Buildings Technology Program currently includes research and development programs in both active and passive solar; this overview focuses on activities in the latter. 6 refs., 39 figs.

1410 Solar Collectors and Concentrators

Refer also to citation(s) 4953

1420 Heat Storage

Refer also to citation(s) 4934, 4953, 5221, 5222, 5223

4957 (CONF-891208–6) **Selection of phase-change and containment materials for thermal energy storage.** Wilson, D.F. (Oak Ridge National Lab., TN (USA)); DeVan, J.H.; Howell, M. Oak Ridge National Lab., TN (USA). [1989]. 14p. Sponsored by National Aeronautics and Space Administration. DOE Contract AC05-84OR21400. From Winter annual meeting of the American Society of Mechanical Engineers; San Francisco, CA (USA); 10-15 Dec 1989. Order Number DE89014778. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The high thermal conductivity and generally low volume change on melting of germanium and alloys based on silicon make then attractive for storage of thermal energy in space power systems. However, this application obviously depends on identification of suitable container materials that are compatible with these metals at the temperature of interest (>1223 K). An approach to solving the containment problem, involving both chemical and physical compatibility, preparation of $NiSi/NiSi_2$, and initial results for containment of germanium and $NiSi/NiSi_2$ are presented. 4 refs., 6 figs., 1 tab.

15 GEOTHERMAL ENERGY

1501 Resources and Availability

4958 (NEDOJ-P–8815) **Review of methods for long term monitoring of the environmental effects of geothermal development (Soil and vegetation). I Main subject. II Collection of data sheets.** New Energy Development Organization, Tokyo (Japan). Mar 1989. 249p. (In Japanese). Order Number DE90725115. Available from NTIS (US Sales Only), PC A11/MF A01.

Appropriate environmental assessment to get social consensus is essential for the promotion of geothermal development. Methods for long term environmental impact monitoring of soil and vegetation systems in relation to geothermal development were examined based on a review of related literature. The current status of geothermal power generation in Japan, construction progress of geothermal power plants, and environmental assessment process is introduced, and soil and vegetation environmental parameters and elements that might be impacted by the construction work were reviewed to identify the problems related to environmental protection. Monitoring programs for soil, vegetation, and inorganic substances at Otake-Hatchobara geothermal areas and the soil and vegetation monitoring for the Matsukawa Geothermal Power Station are shown as exapmples. Soil pH, tree growth vigor, sulfur content of leaves, and the amount of attached moss were studied. Reference data sheets associated with the review of methods for long term environmental monitoring of soil and vegetation in relation to geothermal development is provided as an independent volume. 169 refs., 12 figs., 28 tabs.

1502 Geology and Hydrology of Geothermal Systems

4959 (DOE/ER/13665–1) **Thermal regimes of major volcanic centers: Magnetotelluric constraints: Final report.** Hermance, J.F. Brown Univ., Providence, RI (USA). Dept. of Geological Sciences. 2 Oct 1989. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER13665. Order Number DE90003856. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The interpretation of geophysical/electromagnetic field data has been used to study dynamical processes in the crust beneath three of the major tectono-volcanic features in North America: the Long Valley/Mono Craters Volcanic Complex in eastern California, the Cascades Volcanic Belt in Oregon, and the Rio Grande Rift in the area of Socorro, New Mexico. Primary accomplishments have been in the area of creating and implementing a variety of 2-D generalized inverse computer codes, and the application of these codes to fields studies on the basin structures and he deep thermal regimes of the above areas. In order to more fully explore the space of allowable models (i.e. those inverse solutions that fit the data equally well), several distinctly different approaches to the 2-D inverse problem have been developed: (1) an overdetermined block inversion; (2) an overdetermined spline inverstion; (3) a generalized underdetermined total inverse which allows one to tradeoff certain attributes of their model, such as minimum structure (flat models), roughness (smooth models), or length (small models). Moreover, we are exploring various approaches for evaluating the resolution model parameters for the above algorithms. 33 refs.

1503 Geothermal Exploration and Exploration Technology

Refer also to citation(s) 4959

4960 (NEDOJ-P–8816) **Feasibility study on superconducting technology for geothermal resources exploration.** New Energy Development Organization, Tokyo (Japan). Mar 1989. 101p. (In Japanese). Order Number DE90725119. Available from NTIS (US Sales Only), PC A06/MF A01.

Being consigned by New Energy and Industrial Technology Development Organization, Engineering Advancement Association of Japan was determined to perform the feasibility study on superconducting technology for geothermal resources of which the technology was already practically used in geophisics. The target of the study was to research into possibility to develop superconducting coil for the TDEM method portable transmitter. At first, features and demerits of TDEM method were studied, numerical calculation for layer structure were performed, further the results of measurement for change in natural magnetic field was studied. And research on present condition of TDEM exploration, field survey at JR Railway Technical Research Inst. Miyazaki linear motor car test field where superconducting coil was practically utilized, study on observation in Furukawa Electric Co., Ltd. which was the manufacturer of superconducting coil, were held. According to these research and study, preliminary design of the TDEM method transmitter coil was finished for superconducting and coventional coil. As the result of comparative study for them, it was understood that portable conventional coil was difficult to develop however portable superconducting coil was completely feasible. 39 figs., 5 tabs.

1508 Geothermal Power Plants

4961 (NEDOJ-P–8824) **Investigation on the possibility of enlarging the utilization of geothermal energy.** New Energy Development Organization, Tokyo (Japan). Mar 1989. 239p. (In Japanese). Order Number DE90725121. Available from NTIS (US Sales Only), PC A11.

Engineering Advancement Association of Japan was entrusted by New Energy Development Organization to make an investigation on the possibility of enlarging the utilization of geothermal energy in the fiscal 1988. The investigation was carried out on the practicability and problems of geothermal energy conversion system and of geothermal desalination system based on thermo-pervaporation process. As for the geothermal energy conversion system, a model area was selected and concept designing appropriate for the characteristics of the area was conducted. As a result of the investigation and study, it was confirmed that this system is practicable on middle and small scales from scores to 1000kW, but measures against the catalyst, freons, is a future problem. As for the geothermal desalination system based on thermo-pervaporation process, the system was compared with other various desalination methods and the basic concept of the system was studied. As a result, it was found out that the water produced by this system is purer than that produced by conventional methods and that the system is simpler than conventional methods. There are many points that have to be improved, however, and many subjects that have to be developed. Especially the development of a practical-type membrane module and its demonstration experiments must be carried out urgently. 87 figs., 38 tabs.

1509 Geothermal Engineering

4962 (DOE/SF/16299–T12) **Summary of the planning, management, and evaluation process for the Geothermal Program Review VI conference.** Meridian Corp., Alexandria, VA (USA). Oct 1988. 111p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-86SF16299. Order Number DE90003044. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

The purpose of this document is to present an overview of the planning, facilitation, and evaluation process used to conduct the Geothermal Program Review VI (PR VI) conference. This document was also prepared to highlight lessons learned from PR VI and, by utilizing the evaluation summaries and recommendations, be used as a planning tool for PR VII. The conference, entitled "Beyond Goals and Objectives," was sponsored by the US Department of Energy's (DOE) Geothermal Technology Division (GTD), PR VI was held in San Francisco, California on April 19–21, 1988 and was attended by 127 participants. PR VI was held in conjunction with the National Geothermal Association's (NGA) Industry Round Table. This document presents a brief summary of the activities, responsibilities, and resources for implementing the PR VI meeting and provides recommendations, checklists, and a proposed schedule for assisting in planning PR VII.

4963 (NEDOJ-P–8813) **Survey on enhancement of geothermal well efficiencies.** New Energy Development Organization, Tokyo (Japan). Mar 1989. 261p. (In Japanese). Order Number DE90725116. Available from NTIS (US Sales Only), PC A12.

This report is a reort of the survey made from 26 September, 1988 through 31 March, 1989 and the objectives of the survey were to suvey on the methods to reduce the geothermal well drilling cost which accounts for a good portion of the steam cost constituting 50% of the geothermal power generation cost (a. enhancement of geothermal well drilling efficiencies and b. recovery of as much geothermy as possible). This report is composed of Section 1 (General description), Section 2 (Technology to enhance the geothermal well drilling efficiencies) and Section 3 (Technology for increasing geothermal energy recovery). In section 2, the aerated mud drilling method, the low specific weight (foam) cement method and the top drive drilling method were surveyed and it was concluded that by adopting the aerated mud drilling method and the top drive drilling method, reduction of the working time could be expected by 20-25%. In Section 3, it was concluded that by using hydraulic fracturing, the productivity of a well which was drilled towards a fractured reservoir could be increased, but there were still many unestablished relevant technologies required to be solved. 121 refs., 76 figs., 49 tabs.

1510 Direct Energy Utilization

Refer also to citation(s) 4961

4964 (CONF-891031–8) **Klamath Falls geothermal field, Oregon: Case history of assessment, development and utilization.** Lienau, P.J.; Culver, G.; Lund, J.W. Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center. Sep 1989. 123p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG07-87ID12693. From Annual meeting of the Geothermal Resources Council; Santa Rosa, CA (USA); 1-4 Oct 1989. Order Number DE90003230. Available from NTIS, PC A07/MF A01 - OSTI.

Klamath Falls, Oregon, is located in a Known Geothermal Resource Area which has been used by residents, principally to obtain geothermal fluids for space heating, at least since the turn of the century. Over 500 shallow-depth wells ranging from 90 to 2,000 ft (27 to 610 m) in depth are used to heat (35 MWt) over 600 structures. This utilization includes the heating of homes, apartments, schools, commercial buildings, hospital, county jail, YMCA, and swimming pools by individual wells and three district heating systems. Geothermal well temperatures range from 100 to 230°F (38 to 110°C) and the most common practice is to use downhole heat exchangers with city water as the circulating fluid. Larger facilities and district heating systems use lineshaft vertical turbine pumps and plate heat exchangers. Well water chemistry indicates approximately 800 ppM dissolved solids, with sodium sulfate having the highest concentration. Some scaling and corrosion does occur on the downhole heat exchangers (black iron pipe) and on heating systems where the geo-fluid is used directly. 73 refs., 49 figs., 6 tabs.

4965 (DOE/ID/12693–T6) **Geothermal district piping - A primer.** Rafferty, K. Oregon Inst. of Tech., Klamath Falls, OR (USA). Nov 1989. 52p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG07-87ID12693. Order Number DE90003228. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Transmission and distribution piping constitutes approximately 40 -60% of the capital costs of typical geothermal district heating systems. Selections of economical piping suitable for the fluid chemistry is critical. Presently, most piping (56%) in geothermal systems is of asbestos cement construction. Some fiberglass (19%) and steel

(19%) is also in use. Identification of an economical material to replace asbestos cement is important to future project development. By providing information on relative costs, purchase considerations, existing material performance and new products, this report seeks to provide a background of information to the potential pipe purchaser. A brief discussion of the use of uninsulated piping in geothermal district heating systems is also provided. 5 refs., 19 figs., 1 tab.

16 TIDAL AND WAVE POWER

1605 Environmental Aspects

4966 (ETSU-TID–4069) **Salmon stock monitoring.** Winstone, A.J.; Taylor, A.; Strange, C. UKAEA Harwell Lab. (UK). Energy Technology Div. 1989. 56p. Available from Available from the British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The options for monitoring salmon populations are examined and specific recommendations are made in relation to the assessment of the effects of a tidal energy scheme. The methods examined include electric fishing surveys - juveniles; trapping - juveniles and adults; catch statistics; redd counts; fish counters; tagging juveniles to assess adult return rates; and tracking of individual fish - juveniles and adults. It is concluded from an analysis of available long term data sets that the major limiting factor in salmon stock assessments is the large annual variations in numbers and survival rates at all stages of the life cycle. The analyses also indicate that it is unlikely that a barrage induced reduction in stocks within the range of less than 30% to 50% will be detected by any of the available methods. (author).

17 WIND ENERGY

1706 Wind Energy Engineering

Refer also to citation(s) 4976, 5285

4967 (EPRI-GS–6567) **Solano MOD-2 wind turbine operating experience through 1988: Final report.** Smith, D.R. (Pacific Gas and Electric Co., San Ramon, CA (USA)); Ilyin, M.A. Electric Power Research Inst., Palo Alto, CA (USA); Pacific Gas and Electric Co., San Ramon, CA (USA). c Nov 1989. 52p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This report is on the performance of the 2500 kW MOD-2 wind turbine, owned and operated by the Pacific Gas and Electric Company (PG&E) from 1982 to 1988. The site, located in Solano County, California, has an excellent wind resource. The potential capacity factor (average output over rated output), if the turbine had always been available, is computed. This is compared to the actual capacity factor, and the reasons for the turbine's low availability are discussed. The wind distribution at the site has a good seasonal and time of day fit to PG&E needs, and the capacity credit or load carrying capability (LCC) is computed for the actual MOD-2 performance, and for 100 percent availability. Operations and maintenance problems and costs are given, and compared to those of smaller turbines. The economics of the turbine are also considered. 12 refs., 20 figs., 8 tabs.

4968 (ETDE-IT–89-36) **Wind energy research and development in Italy.** Foli, U.; Sesto, E. ENEA, Casaccia (Italy). Centro Ricerche Energia. 1988. 5p. (CONF-8810453–1: European community wind energy conference, Herning (Denmark), 6-10 Oct 1988). Order Number DE90724626. Available from NTIS (US Sales Only), PC A02.

Paper presented at 1988 European Community wind energy (Herning, Denmark, 6-10 Oct 1988).

Most of the activities currently under way in Italy in the field of wind power are carried out within the framework of the National Wind Energy Programme. A number of public bodies and industrial companies are involved in this programme and have launched noteworthy projects covering many areas of the wind energy sector. This report supplies information on the progress of these activities, with special reference given to those regarding the development of Italian made wind energy conversion systems.

4969 (ETDE-IT–89-39) **Wind tunnel measurements of aerodynamic coefficients of asymetrical airfoil sections: wind turbine blades extended to high angles of attack.** Massini, G.; Rossi, E.; D'Angelo, S. ENEA, Rome (Italy); Politecnico di Torino, Turin (Italy). 1988. 14p. Order Number DE90724627. Available from NTIS (US Sales Only), PC A03.

Paper presented at 1988 European Community wind energy, Herning (Denmark), 6-10 Oct 1988.

Wind turbine blades operate very frequently at angles of attack well beyond those commonly dealt with in aeronautics. This means that conventional airfoil data used for aircraft design, and usually available, are not sufficient for wind turbine applications. To try to partially fill this gap, a facility was set up:(1) to test an experimental methodology to determine the aerodynamic characteristics (lift, drag, moment coefficients) of airfoil sections at high angles of attack in two-dimensional flow;(2) to determine the aerodynamic characteristics and pressure distribution up to high angles of attack, in a two-dimensional flow, of six airfoil sections, selected among those more suitable for wind turbine applications.

4970 (ETSU-WN–5096) **Characterisation of wind turbine wake turbulence and its implications on wind farm spacing: (Wake turbulence characterisation).** UKAEA Harwell Lab. (UK). Energy Technology Div.; Flight Refuelling Ltd., Wimborne (UK). 1989. 95p. Available from Available from the British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

The serious consideration now being given to the construction of medium sized wind farms in the UK has posed a number of new technical questions for the wind turbine industry. One such question of particular importance is concerned with how much is known about the loading experienced by wind turbines operating in the wake of others. A Project has been set up to address that question by drawing together all available experimental data describing the wake structure of wind turbines, developing a method to predict wake turbulence and, finally, using this method in conjunction with existing structural dynamic codes to calculate wake flow induced loading and fatigue damage. This document is Part 1 of the Final Report of the Project and presents a review of the progress that has been made in the studies of wind turbine wakes and of wake turbulence in particular. The analysis of available wake turbulence data and the development of a reliable empirical characterisation is also reported. (author).

4971 (NEDOJ-P–8829) **Study on wind condition for medium/small sized wind power generation.** New Energy Development Organization, Tokyo (Japan). Mar 1989. 232p. (In Japanese). Order Number DE90725117. Available from NTIS (US Sales Only), PC A11.

In order to promote installation of medium/small sized wind power generation in Japan, the observation on wind condition and evaluation of wind energy was conducted for seven months since September, 1988 to March, 1989, at Itoshiki area, Okinawa prefecture, selected from the candidacy sites in the 1987, by Chiyoda Dames and Moore Co., Ltd., being consigned by New Energy and Industrial Technology Development Organization. Windmill type wind direction and anemometer was used as observation equipment, and observed height were two regions of 10 and 20 meters above ground, items to be observed were wind direction, average wind speed for 10 minutes together with instantenious one. By the results of the observation and its evaluation, it was shown that monthly mean wind speed was from five to eight m/s at a height of 20 meters, required wind energy was 1209 kWh/m^2 in total period, and it was understood that 100kW class windmill was completely feasible. As to the problems in the future, it seems to be in need that the observation on wind condition for promising area and feasibility study suitable to select the area are to be conducted. 51 figs, 41 tabs.

4972 (PB–89-873095/XAB) **Windmill design, development, construction, and performance. November 1982-September 1988 (Citations from Fluidex data base). Report for November 1982-September 1988.** National Technical Information Service,

Springfield, VA (USA). Oct 1989. 112p. Available from NTISPC N01/MF N01.

See also PB–89-873103.

This bibliography contains citations concerning the design, development, construction, and performance of windmills and associated systems, subsystems, and components. Both aerodynamic and structural-performance characteristics are discussed. Included are references to siting characteristics, power production and windmill efficiency, and specific system descriptions. (This updated bibliography contains 331 citations, none of which are new entries to the previous edition.)

4973 (PB–89-873103/XAB) **Windmill design, development, construction, and performance. October 1988-October 1989 (Citations from Fluidex data base). Report for October 1988-October 1989.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 41p. Available from NTISPC N01/MF N01.

Supersedes PB–88-869466. See also PB–89-873095.

This bibliography contains citations concerning the design, development, construction, and performance of windmills and associated systems, subsystems, and components. Both aerodynamic and structural-performance characteristics are discussed. Included are references to siting characteristics, power production and windmill efficiency, and specific system descriptions. (This updated bibliography contains 94 citations, all of which are new entries to the previous edition.)

4974 (PNL-SA–17459) **Turbulent wind at the equatorial segment of an operating Darrieus wind turbine blade.** Connell, J.R. (Colorado State Univ., Fort Collins, CO (USA). Dept. of Civil Engineering); Morris, V.R. Pacific Northwest Lab., Richland, WA (USA). Sep 1989. 20p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. (CONF-8901170–1: 9. wind energy symposium, New Orleans, LA (USA), 14-18 Jan 1989). Order Number DE90002672. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Six turbulent wind time series, measured at equally spaced equator-height locations on a circle 3 m outside a 34-m Darrieus rotor, are analyzed to approximate the wind fluctuations experienced by the rotor. The flatwise lower root-bending stress of one blade was concurrently recorded. The wind data are analyzed in three ways: wind components that are radial and tangential to the rotation of a blade were rotationally sampled; induction and wake effects of the rotor were estimated from the six Eulerian time series; and turbulence spectra of both the measured wind and the modeled wind from the PNL theory of rotationally sampled turbulence. The wind and the rotor response are related by computing the spectral response function of the flatwise lower root-bending stress. Two bands of resonant response that surround the first and second flatwise modal frequencies shift with the rotor rotation rate. 5 refs., 9 figs.

4975 (SAND–88-3231C) **Visualization of boundary layer transition zone movement on oscillating airfoils with shear-sensitive liquid-crystal coatings.** Reda, D.C. (Oak Ridge National Lab., TN (USA)); Butterfield, C.P. Sandia National Labs., Albuquerque, NM (USA). [1989]. 14p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-76DP00789. (CONF-891208–2: Winter annual meeting of the American Society of Mechanical Engineers, San Francisco, CA (USA), 10-15 Dec 1989). Order Number DE89009570. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Oscillating, and post-stall static, airfoil experiments were conducted to test the frequency response of shear-stress-sensitive/temperature-insensitive liquid crystal coatings. The airfoil was a natural-laminar-flow profile designed specifically for vertical axis wind turbine applications (the SAND 0018/50). A full-span model of this contour was exposed to incompressible flows at a freestream Reynolds number (based on chord) of 1.0×10^6. Angle-of-attack forcing function was a sine wave of amplitude $\pm$ 10° about a mean angle of 0°. Frequencies of oscillation were 0.2, 0.6 and 1.2 hertz, corresponding to reduced frequencies of 0.006, 0.018 and 0.037. Post-stall static experiments were conducted at a fixed angle of attack of 14°, a condition that yielded unsteady leading-edge separation phenomena. Data acquisition was accomplished by video recording. Observations of boundary layer transition zone movement and unsteady leading-edge separation showed the liquid crystal technique capable of visualizing transient surface shear stress events over the stated dynamic range in a continuous and reversible manner, with a color-change response time of less than 0.03 seconds (the framing rate of standard video equipment). 14 refs., 3 figs.

20 FOSSIL-FUELED POWER PLANTS

2001 Power Plants and Power Generation

Refer also to citation(s) 4645, 4708, 5146, 5629, 5646, 5651, 5686, 5791

4976 (CEGB-RD/L–3343/R88) **Applications and real life spectra in the power generation industry.** Nix, K.J.; Lindley, T.C. Central Electricity Research Labs., Leatherhead (UK). Dec 1988. 22p. Order Number DE90610117. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Loading spectra encountered in various structures, machines, and components in the Power Generation Industry are presented from the viewpoint of fatigue analysis and structural integrity assessment. Although particular attention is paid to loading transients in turbogenerators, other items such as pressure vessels, pumped storage, nuclear plant pressure circuitry and wind turbines are also considered. (author).

4977 (CRIE-T–88041) **Development of autonomous decentralized preventive control system. Prevention of overload and abnormal voltage using decomposition principle.** Hirata, Yuichi; Kurihara, Ikuo; Uchida, Naoyuki. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Mar 1989. 33p. (In Japanese). Order Number DE90725002. Available from NTIS (US Sales Only), PC A03/MF A01.

In order to prevent large-scale stoppage of electric supply which has great influence on civil activities, completion of online security control are needed. The autonomous decentralized system is considered as an effective measure to implement online security control for large electric power systems. In this report the authors developed an autonomous decentralized system to prevent overlaod and abnormal voltage of power system using the decomposition principle of Linear Programming, applied it to two model systems and studied its basic property. Main results are as follows. By autonomous decentralization of system, dimension and duration of computation on large power system were reduced. Controllability and economical efficiency of autonomous decentralized system is not so inferior to that of the conventional cerntralized system. Proposed system can keep the additional cost associated with the preventive control by ELD for overload at the expected contingencies minimum. 5 refs., 13 figs., 3 tabs.

4978 (EPRI-CS–4252-Vol.8) **Dissimilar-weld failure analysis and development program: Volume 8, Design and procedure guide for improved welds: Final report.** Roberts, D.I. (General Atomics, San Diego, CA (USA)); Ryder, R.H.; Grunloh, H.J.; Thurgood, B.E. Electric Power Research Inst., Palo Alto, CA (USA); Materials Properties Council, Inc., New York, NY (USA). c Nov 1989. 31p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

As a result of the work performed under RP 1874-1, the factors influencing the performance of dissimilar metal welds (DMWs) in elevated temperature power plant boiler service have been defined. Details of the results are given in other volumes of this report series. In this volume, design and procedure guidelines for improving DMW performance are provided. DMW life can be extended by: locating DMWs such that service conditions are conducive to long life; such locations may be identified by the use of the computerized analytical program PODIS, developed under RP 1874; using preferred weld filler metals; and using specific weld configurations. Details of each of these approaches are described herein. 5 figs., 2 tabs.

4979 (EPRI-GS–6398) **Guidelines for prevention of cavitation in centrifugal feedpumps: Final report.** Gulich, J.F. (Sulzer Bros. Ltd., Winterthur (Switzerland)). Electric Power Research Inst., Palo Alto, CA (USA); Sulzer Bros. Ltd., Winterthur (Switzerland). c

Nov 1989. 195p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

Unscheduled outstages and deratings caused by problems with feed pumps cost utilities an estimated $460 million in replacement power costs in 1985. Cavitation is one of the leading causes of feed pump failures. This report describes the factors influencing cavitation erosion and presents two correlations developed to predict erosion rates in pumps. Based on field and laboratory data two correlations were developed to predict cavitation erosion rates in feed pump impellers. Key to the success was the derivation of suitable similarity parameters which combine the different factors determining metal loss due to cavitation. One correlation is based on data which can be obtained from shop flow visualization tests and the other correlation is based on acoustic data which can be obtained during shop or field tests. The correlations developed permit predicting impeller lifetimes and assessing the relative benefits of design improvements before installing the pumps in the field. Feed pump suction conditions can be related to impeller life, a parameter which has meaning to the utility. The impact of decisions regarding plant design and operation can be assessed with these correlations. 29 refs., 51 figs., 7 tabs.

4980 (ETDE-IT–89-26, pp. 7-58) **Thermodynamics and heat exchange devices.** Bejan, A. (Duke Univ., Durham, NC (USA). Dept. of Mechanical Engineering and Material Science). Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica. [1988]. (In Italian). (CONF-8705391–1: 4. international symposium on second law analysis of thermal systems, Rome (Italy), 25-30 May 1987). In *4th International symposium on second law analysis of thermal systems.* Order Number DE90705982. Available from NTIS (US Sales Only), PC A04.

Paper presented at 4th International symposium on second law analysis of thermal systems (Rome 25-30 May 1987).

This paper reviews research efforts in the area of thermodynamic irreversibility of heat exchange components and systems, as well as, their design based on the minimization of the generation of entropy. The examination initially focusses upon the fundamental mechanisms responsible for the generation of entropy in heat and fluid flows and upon design compromises made to establish an equilibrium between the irreversibility of the fluid flow. The applications were chosen with reference to the field of heat exchange mechanisms and heat exchanger design (e.g. power plant components: reheaters, expanders, regenerators, coolers, compressors).

4981 (ETDE-IT–89-26, pp. 59-79) **Conceptual design of energy systems: simulation /optimization.** El-Sayed, W.M. (Lowell Univ., MA (USA)); Gaggioli, R.R. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica. [1988]. (In Italian). (CONF-8705391–1: 4. international symposium on second law analysis of thermal systems, Rome (Italy), 25-30 May 1987). In *4th International symposium on second law analysis of thermal systems.* Order Number DE90705982. Available from NTIS (US Sales Only), PC A04.

Paper presented at 4th International symposium on second law analysis of thermal systems (Rome, 25-30 May 1987).

The evolutive process of the conceptual design of energy systems and of the use of mathematical techniques for design optimization were integrated into a single 'do-it-yourself' program which allows the efficacious evaluation and optimization of a large number of systematic configurations. Interactions between dissipations and dissipators can be verified and analyzed to establish pilot indicators with the aim of achieving optimal configurations. The principal characteristics of this program are briefly described in this paper. An example demonstrates the integration of design synthesis and optimization. The distribution of dissipations and considered solutions are examined for this exemplary problem which deals with the optimization of power obtained from 1000 degree F exhaust gases deriving from a gas turbine burning butane. The search is for a steam turbine power cycle downstream a 'bottoming steam power cycle'. The gas temperature must not decrease below 200 degrees F and steam quality in expansion must not fall below 85%.

2002 Waste Management

Refer also to citation(s) 4590, 4591, 4592, 4640, 5240

4982 (DOE/PC/88866–T5) **Flue gas conditioning for fabric filter performance improvement: Quarterly technical progress report, July–September 1989.** Miller, S.J.; Laudal, D.L.; Weber, G.F. North Dakota Univ., Grand Forks, ND (USA). Energy and Mineral Research Center. Oct 1989. 11p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC22-88PC88866. Order Number DE90003035. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The objective of this project is to develop a particulate control technology that can reliably remove particulate matter with particle diameters from 0.01 to 10 micrometers from a flue gas stream, with a removal efficiency of at least 99.9% for all particle sizes, independent of coal type. The method involves injection of conditioning agents ammonia and sulfur trioxide into the flue gas upstream of a baghouse to increase particle collection efficiency and simultaneously reduce baghouse pressure drop. It is the goal of the proposed research to develop this technology to the point where it is ready for field testing at the pilot level or compartment level at a full-scale utility power plant. Accomplishments this quarter included the completion of tests with a powder characteristics tester to evaluate the effect of conditioning on physical ash characteristics.

4983 (PB–89-233571/XAB) **Evaluation of auxiliary tempering pump effectiveness at Chalk Point Steam Electric Station.** Wendling, L.C.; Holland, A.F. Versar, Inc., Springfield, VA (USA). Aug 1989. 101p. Available from NTIS, PC A06/MF A01.

The effectiveness of auxiliary tempering pump operation at Chalk Point Steam Electric Station (SES) at reducing plant-induced mortality of aquatic biota was evaluated. Several Representative Important Species (RIS) and dominant benthic and zooplankton species were used in the evaluation as indicators of overall system-wide responses. Expected mortality with and without auxiliary pump operation was estimated using thermal tolerance data available from the scientific literature for blue crabs, white perch, striped bass, spot, Macoma balthica and Acartia tonsa. The evaluation led to the conclusion that the operation of auxiliary tempering pumps at Chalk Point SES increases plant-induced mortality of spot, white perch, striped bass, and zooplankton. Operation of the tempering pumps may reduce blue crab mortality slightly under certain circumstances, and Macoma balthica mortality is probably largely unaffected by their operation.

4984 (PB–89-236368/XAB) **Enhancement of reactivity in surfactant-modified sorbents for sulfur dioxide control.** Kirchgessner, D.A.; Jozewicz, W. Acurex Corp., Research Triangle Park, NC (USA). 1989. 8p. Available from NTIS, PC A02/MF A01.

Pub. in Industrial and Engineering Chemistry Research, Vol. 28, No. 4, 413-418(Apr 1989).

Injection of calcium-based sorbents into the post-flame zone of utility boilers is capable of achieving sulfur dioxide (SO_2) captures of 50-60% at a stoichiometry of 2. Calcium hydroxide (Ca(OH)2) appears to be the most effective commercially available sorbent. Recent attempts to modify $Ca(OH)_2$ by adding calcium lignosulfonate with the water of hydration have succeeded in enhancing its effectiveness. The particle size reduction, which in some applications accompanies lignosulfonate addition, does not appear to be a prerequisite for increased SO_2 capture. Similarly, the accelerated rate of dehydration observed in modified hydroxides does not appear to be an important mechanism in the enhancement. The primary cause of increased reactivity in modified sorbents is the ability of calcium lignosulfonate to retard the rate of sintering and thus to retain pore volume and reactive surface area.

4985 (PB–89-236392/XAB) **Identification of $CaSO_4$ formed by reaction of CaO and SO_2. Report for October 1988-March 1989.** Gullett, B.K.; Bruce, K.R. Acurex Corp., Research Triangle Park, NC (USA). 1989. 15p. Available from NTIS, PC A03/MF A01.

This article discusses the XRD determination of the identity of $CaSO_4$, formed by the reaction between CaO and SO_2, and the support of that determination by density measurements with helium pycnometry. The anhydrous $CaSO_4$ compound formed has an orthorhombic crystal structure and an analytically calculated density of

2.98 g/cu cm, versus the JCPDS reported value of 2.995 g/cu cm. The product of this reaction, formed during calcium-based sorbent injection for SO_2 removal from coal-fired power plants, has largely been assumed to have a density of 2.61 g/cu cm. Since reaction models must incorporate the product density in determining the rate of sorbent pore blockage or filling, correct identification of the reaction product is crucial.

4986 (PB–89-237127/XAB) **Porosity, surface area, and particle size effects of CaO reacting with SO_2 at 1100c.** Gullett, B.K.; Blom, J.A.; Cunningham, R.T. Acurex Corp., Research Triangle Park, NC (USA). 1988. 14p. Available from NTIS, PC A03/MF A01.

Pub. in Reactivity of Solids, Vol. 6, 263-275(1988).

This paper gives results of tests for the reactivity of calcium oxide (CaO) sorbents derived from calcium hydroxide ($Ca(OH)_2$) and calcium carbonate ($CaCO_3$) to gaseous sulfur dioxide (SO_2) in a nitrogen atmosphere with a nominal 1100 C, entrained flow reactor and a solids residence time of 0.74 s. The research included direct examination of the combined effect of porosity, particle size, and surface area upon CaO conversion to calcium sulfate ($CaSO_4$). Conversion was inversely related to the 0.20 to 0.35 power of particle size for diameters ranging from 0.77 to 12.1 micrometers. Increased initial surface area from 7 to 62 sq m/g led to higher conversions at all particle sizes, eliminating the possibility of gas film diffusion control. The conversion for both sorbent types is proportional to initial porosity. Substantial expansion of the sorbents during reaction was shown by achieving conversion levels much greater than theoretically possible, given the initial sorbent porosity, the larger-volume product, and an assumed constant particle size. This is contrary to most modeling assumptions, in which the reaction is limited or cut off by pore filling or pore plugging of the sorbent volume.

4987 (SPC–532G546-Vol.1) **Demonstration of a modified combustion emission control system with sorbent injection for NO^x and SO^2 reduction: Volume 1.** Gass, D.J.; Feindel, R.G. Saskatchewan Power Corp., Regina, SK (Canada); Combustion and Engineering, Ottawa, ON (Canada). Feb 1987. 169p. (CE–02794). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

The primary objective of the study described in this report was to demonstrate a relatively low cost technology to control both NO_x and SO_2 emissions for low rank fuels on a full-scale 150 MW lignite coal fired steam generator. The development of a Modified Combustion Emission Control System with Sorbent Injection is detailed. The demonstration plant and operational experience with the plant are described. The test program carried out with the demonstration plant using two Saskatchewan lignite coals, Boundary Dam and Shand, and two sorbents, limestone and pressure hydrated lime, is outlined. Test results are presented for NO_x and SO_2 emissions reduction, and the effect of the demonstration plant on ash deposition and slagging, steam generator efficiency, and fly ash resistivity. An economic evaluation of the use of the two sorbents is presented. 22 refs., 58 figs., 14 tabs.

4988 (SPC–532G546-Vol.2) **Demonstration of a modified combustion emission control system with sorbent injection for NO^x and SO^2 reduction: Volume 2: Appendices.** Gass, D.J.; Feindel, R.G. Saskatchewan Power Corp., Regina, SK (Canada); Combustion and Engineering, Ottawa, ON (Canada). Feb 1987. vp. (CE–02792). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

This volume of appendices describes sampling procedures, measurement procedures, equipment, and calculation methods employed with pre- and post-modifications tests for chemical analysis of brown coal, fly ash, bottom ash, ash deposits and sorbents, and flue gas. A compilation of the analytical data on chemical composition of the analytes is included as well as results from the statistical analysis of this data. 47 figs., 9 tabs.

2004 Health and Safety

Refer also to citation(s) 5646

2005 Environmental Aspects

Refer also to citation(s) 5887

21 NUCLEAR POWER PLANTS

Refer also to citation(s) 6453, 6454, 6456

4989 (INIS-BR–1690) **Nuclear power plants of small and medium size, safety, a technological option in developing countries for the next decade.** Maiorino, J.R. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). Div. de Fisica de Reatores. 1989. 1p. (In Portuguese). (CONF-890699–: Symposium on importance of nuclear power for power supply after 1990: benefits and difficulties, Rio de Janeiro (Brazil), 11-15 Jun 1989). Order Number DE90610153. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. NUCLEAR POWER PLANTS/ specifications; COST; SPECIFICATIONS

4990 (INIS-mf–11562, pp. 78) **Principles of deriving intervention levels in case of radiation accident.** Tatara, M. (Vyskumny Ustav Preventivneho Lekarstva, Bratislava (Czechoslovakia)); Vladar, M. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. RADIATION ACCIDENTS/ emergency plans; RADIATION DOSES; RADIATION PROTECTION; RECOMMENDATIONS

4991 (INIS-mf–11562, pp. 85) **Register of radiation accidents and analysis of their causes.** Tuscany, R. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni). Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. RADIATION ACCIDENTS/ human factors; DATA ACQUISITION; EMERGENCY PLANS; EXTERNAL IRRADIATION; PERSONNEL

4992 (INIS-mf–11563) **VII international district heating conference.** Ceskoslovenska Vedeckotechnicka Spolecnost, Prague (Czechoslovakia). Dum Techniky. 1988. 1093p. (In French, English, Russian, (CONF-8809397–: 7. international district heating conference, Prague (Czechoslovakia), Sep 1988). Order Number DE90608686. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Published in 3 volumes.

The proceedings of the 7th International District Heating Conference contain the full texts of the 89 presented papers of which 11 fall under the INIS Subject Scope. The conference met in seven sessions and dealt with the following problem areas: design and optimization of systems of district heating, integration of the power system and the district heating systems, cooperation of nuclear and fossil burning sources in district heating systems, the use of specific nuclear power plants for heating purposes, questions of the control of systems of district heating, the development of components of

heating networks, the reliability and design of heat supply pipes. (Z.M.).

4993 (INIS-mf–11563, pp. 121-127) **Heat from nuclear power plants used in agriculture.** Juza, J. Ceskoslovenska Vedeckotechnicka Spolecnost, Prague (Czechoslovakia). Dum Techniky. 1988. (In Czech). (CONF-8809397–: 7. international district heating conference, Prague (Czechoslovakia), Sep 1988). In *VII international district heating conference.* Order Number DE90608686. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.
Published in 3 volumes.

The possibilities are discussed of using nuclear power plants as heat sources for agriculture in Czechoslovakia. It is estimated that agrocomplexes will account for 5-10% of the total power consumption in Czechoslovakia. This value should be one of the major indicators for decision making on the siting of nuclear power plants, on the time of their construction and on their incorporation in the district heating system. The best conditions for this have been created at the nuclear power plant in Jaslovske Bohunice. On the locality are the Research Institute for Nuclear Power Plants and in the vicinity the research institutes of the Agricultural University in Nitra. There is fertile arable land and conditions for the establishment of agrocomplexes also in the localities of other nuclear power plants which are under construction or are being operated in Czechoslovakia, namely Dukovany, Mochovce and Temelin. Agrocomplexes should be established in these areas gradually in the years 2000 to 2010. The Litomerice agrocomplexes which should be completed by 2015 should be highly profitable and should be supplied from the nuclear power plant in Usti nad Labem with a capacity of 2 x 1000 MW. The same is true of the Eastern Bohemia agrocomplex which should similarly be supplied by a nuclear power plant to be built in this area after the year 2020. (Z.M.).

4994 (INIS-mf–11563, pp. 167-178) **Prospects of district heating of large towns in Poland by exploitation of nuclear and conventional power plants.** Bober, M.; Kiczko, J. Ceskoslovenska Vedeckotechnicka Spolecnost, Prague (Czechoslovakia). Dum Techniky. 1988. (In Russian). (CONF-8809397–: 7. international district heating conference, Prague (Czechoslovakia), Sep 1988). In *VII international district heating conference.* Order Number DE90608686. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.
Published in 3 volumes.

Factors are discussed which in Poland limit the construction of power plants burning coal, namely the present tense balance and the deficit of the raw material in the near future, the lack of suitable localities for the construction of such power plants, their great distance from the consumers, environmental protection requirements and economic problems. The analysis shows limited possibilities of using conventional power plants for district heating. For the near future some 10 conventional power plants will be expected to operate as heat sources both for technical and economic reasons. The concept is proposed of supplying big cities with heat from conventional and nuclear power plants and the basic principles are outlined of the development of existing heating systems based on these heat sources. The transport is envisaged of heat to great distances and the parallel operation of distant heat sources for basic load and local sources for covering peak load. (Z.M.).

4995 (INIS-mf–11563, pp. 657-669) **Optimization of district heating using a nuclear heat source.** Urbanek, J. Ceskoslovenska Vedeckotechnicka Spolecnost, Prague (Czechoslovakia). Dum Techniky. 1988. (In Czech). (CONF-8809397–: 7. international district heating conference, Prague (Czechoslovakia), Sep 1988). In *VII international district heating conference.* Order Number DE90608686. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.
Published in 3 volumes.

Discussed in detail are the results of the optimization of the system of district heating with a peak heat output of 1,000 MW with the nuclear power plant as the main source of heat. The optimization criterion was the production cost of the unit of heat power. The heat chart of the turbine was alternatively designed at a heating plant coefficient of 0.5, i.e., at withdrawal of 500 MW from the nuclear source for covering the peak heat output of 1,000 MW: at different temperature of return water a different degree of heating within the range of 20 to 130 degC, the number of heating steps from 1 to 5, etc. The length of the heat supply pipe was chosen in four variants: 20, 40, 60 and 80 km. Also made was the optimization of the district heating system with a peak heat output of 1,000 MW where a nuclear heating plant is the basic source and the length of the supply pipe is 5 km and the peak sources are natural gas burning boiler plants. The aim of the study was to determine the optimal size of the heating coefficient, i.e., the share of the nuclear heating plant in the peak output of the system. The optimization criterion was production cost of a unit of heat power. It was found that the growth of specific capital costs for one nuclear heating plant reduces the value of the optimal heating coefficient. (Z.M.). 12 figs., 1 tab., 4 refs.

2101 Power Reactors, Nonbreeding, Light-Water Moderated, Boiling Water Cooled

Refer also to citation(s) 5059, 5060, 5061, 5063, 5068, 5069, 5071, 5115, 5129, 5144, 5148, 5150, 5157, 5184, 5196, 5197, 5200, 5202, 5203, 5204

4996 (ETDE-IT–89-24) **Volumetric properties of organic fluids for direct and inverse thermodynamic cycles.** Cau, G.; Cipollone, R.; Pelagagge, M.P. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica. Nov 1988. 53p. Order Number DE90724673. Available from NTIS (US Sales Only), PC A04/MF A01.

An analytical method, based on a BWR type equation of state, for calculating the thermodynamic properties of working fluids, is examined in three parts - analytical and logical development; theoretical considerations on the derivatives of the thermodynamic functions; analysis of thermodynamic consistency. Starting from any pair of thermodynamic variables of practical interest, the method, developed from a volumetric equation of state and an auxiliary vapor pressure equation, allows the determination of the state equilibrium properties of pure organic compounds. It is checked by calculating some derived thermodynamic functions such as specific heats, speed of sound and the Joule-Thomson coefficient.

4997 (ETDE-IT–89-24, pp. 7-21) **An analytical method, based on a BWR-type equation of state, for calculating the thermodynamic properties of working fluids. Part 1: Analytical and logical development.** Cau, G. (Cagliari Univ. (Italy). Dipt. di Ingegneria Meccanica); Cipollone, R.; Pelagagge, M.P. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica. Nov 1988. In *Volumetric properties of organic fluids for direct and inverse thermodynamic cycles.* Order Number DE90724673. Available from NTIS (US Sales Only), PC A04/MF A01.

In this work, a procedure for determining the thermodynamic properties of organic working fluids is proposed which proves particularly suitable for optimizing direct and inverse thermodynamic cycles. Starting from any pair of thermodynamic variables of practical interest, the method, based on a volumetric equation of state and an auxiliary vapor pressure equation, allows the determination of the state equilibrium properties of pure organic compounds. This paper, concerning the first part of the work, describes the logical procedures for finding the different regions (liquid, vapor, etc.), after presenting the basic equations used.

4998 (ETDE-IT–89-24, pp. 37-53) **An analytical method, based on a BWR-type equation of state, for calculating the thermodynamic properties of working fluids. Part 3: Analysis of thermodynamic consistency.** Cau, G. (Cagliari Univ. (Italy). Dipt. di Ingegneria Meccanica); Cipollone, R,; Pelagagge, M.P. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica. Nov 1988. In *Volumetric properties of organic fluids for direct and inverse thermodynamic cycles.* Order Number DE90724673. Available from NTIS (US Sales Only), PC A04/MF A01.

The procedure for calculating the state properties of pure fluids developed by the authors in the previous parts of this work is checked here by calculating some derived thermodynamic functions such as specific heats, speed of sound and the Joule-Thomson coefficient. The results, compared with experimental data for eight organic fluids of interest in heat pumps and closed cycle power systems (R-12, R-13, R-21, R-22, R-23, R-C318, isobutane, chlorobenzene) show that the proposed method, based on a volumetric, BWR type, equation of state, affords a correct estimate of the thermal properties. An analysis of the propagation of uncertainty of

the volumetric to the thermal properties confirms the reliability of the method for predicting the thermodynamic behaviour of pure fluids.

4999 (ETDE-IT–89-24, pp. 23-36) **An analytical method, based on a BWR-type equation of state, for calculating the thermodynamic properties of working fluids. Part 2: Theoretical considerations on the thermodynamic functions' derivatives.** Cau, G. (Cagliari Univ. (Italy). Dipt. di Ingegneria Meccanica); Cipollone, R.; Pelagagge, M.P. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica. Nov 1988. In *Volumetric properties of organic fluids for direct and inverse thermodynamic cycles.* Order Number DE90724673. Available from NTIS (US Sales Only), PC A04/MF A01.

An analytical procedure developed from a BWR type equation of state was presented in the first part of this work for determining the thermodynamic properties of pure fluids. The procedure, based on a volumetric equation of state and an auxiliary vapor pressure equation, applys sophisticated algorithms for solving the thermodynamic functions and for automatically identifying the physical state of the fluids. In this part, some theoretical aspects on the derivatives of the equilibrium properties, required in addition to the mentioned algorithms, are discussed in detail, as well as, the implications relative to the development of an additional equation that could serve to describe saturation conditions.

5000 (INIS-mf–11564, pp. 100-114) **On a complex investigation method for heat transfer intensification via spacers in nuclear reactor fuel rod clusters.** Wolter, W. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1985. (In Russian). (CONF-8410495–: Thermal physics '84: thermal aspects of WWER nuclear reactor safety, Varna (Bulgaria), Oct 1984). In *Thermal physics 84. Thermal aspects of WWER nuclear reactor safety. V. 2. Collection of papers from CMEA seminar, Varna, October 1984.* Order Number DE90705979. Available from NTIS (US Sales Only), PC A14/MF A01; INIS.

The paper presents experimental results conserning: kinematics of single-phase rotating flow in channels of various geometry including rod clusters; heat transfer crisis and temperature regimes in the past-critical area investigated on shortened fuel rod cluster mockups fed by steam-water mixture; impact of some structural elements of flow turbulators on the liquid film motion under adiabatic conditions. These studies allow the thermal-hydraulic optimization of various types of the flow turbulators employed in the fuel channels of BWRs. 9 refs.; 1 tab.; 5 figs.

5001 (INIS-mf–11564, pp. 141-157) **Results of flow instability study in a system of parallel steam generating channels.** Wolter, W. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1985. (In Russian). (CONF-8410495–:). In *Thermal physics 84. Thermal aspects of WWER nuclear reactor safety. V. 2. Collection of papers from CMEA seminar, Varna, October 1984.* Order Number DE90705979. Available from NTIS (US Sales Only), PC A14/MF A01; INIS.

A number of problems has been investigated in connection with the interchannel pulsating (ICP) in systems with parallel steam generating channels, such as: ICP connection with the thermal-hydraulic characteristics of a single channel, ICP period connection with the coolant transport time in the channel, differences in ICP onset conditions for vertical and horizontal channels. The experimental mockup for the ICP study in vertical/horizontal position included two or three sections with joint inlet/outlet manifolds. Each section consisted of an inlet, heated and outlet parts. The experimental technique for finding the ICP range boundaries on the mass flow rate/inlet temperature plane looked like follows: the inlet temperature was uniformly varied at constant levels of pressure, heat flux density and mass flow rate. The bottom and top ICP boundaries with respect to the inlet temperature was fixed by starting and ending of regular flow rate oscilations in the channels. The experimental results are presented and a criterion suggested for determining the ICP boundaries. The major advantage of this criterion is that its value can be found from experiments with a single steam generating channel under stationary conditions. 9 refs.; 8 figs.

5002 (IWGFPT–32, pp. 56-66) **Burnup and plutonium distribution near the surface of high burnup LWR fuel.** Matsumura, T. (Central Research Inst. of Electric Power Industry, Tokyo (Japan). Komae Research Lab.); Kameyama, T. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

In a LWR fuel, production of plutonium is greater at the pellet surface than at the center, and burnup and power generation rate at the surface becomes larger than averaged value of the pellet. This phenomenon is called surface effect. Since the surface effect has much influence on the fuel performance evaluation, a detailed calculation code for burnup and power generation rate distribution in a fuel pellet have been developed. By fitting the results from this calculation code, a simple calculation model for surface effect was devised. Combining this simple model with the fuel performance evaluation code, fuel center temperature and FP gas release rate are calculated, showing that remarkably reduced fuel temperature and release rate are obtained when considering surface effect. It is indicated that utilization of this simple calculation model for surface effect enable us to improve the accuracy of fuel performance evaluation at high burnup. (author). 3 refs, 8 figs, 2 tabs.

5003 (IWGFPT–32, pp. 91-101) **Modelling of PCI under steady state and transient operating conditions.** Rashid, Y.R. (Anatech International Corp., La Jolla, CA (USA)); Zangari, A.J.; Lin, C.L. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

A model for predicting LWR fuel response to Pellet-Clad Interaction (PCI) is described. The model is incorporated in FREY which is a two-dimensional transient and steady state fuel pin code. The geometry and the force transfer characteristics of the fuel-cladding interface are treated within the finite element method, which is the computational framework of the FREY code. An important feature of this model is the discrete modeling of pellet cracks. A failure criterion based on stress corrosion cracking is used as a measure for crack initiation. This criterion is incorporated in a cumulative damage model in which a theoretical failure index is calculated as a function of the cladding yield stress, the computed hoop stress, time and burnup. Data obtained in Iodine-SCC tests of unirradiated and irradiated zircaloy-2 and zircaloy-4 pressurized tube specimens form the database for the failure criterion. The PCI model also utilizes a fracture criterion based on linear elastic fracture mechanics. The stress intensity factor K_I is calculated for a prescribed flaw size and compared with the material's fracture toughness K_{IC}, which is available as a function of temperature and fast fluence. Predictions of this model are illustrated by several examples and compared to PCI tests. (author). 9 refs, 17 figs.

5004 (IWGFPT–32, pp. 115-135) **Fuel behavior modelling code FEMAXI-IV and its application.** Nakajima, T. (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Fuel Reliability Lab. I); Saito, H.; Ousaka, T. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September*

1988. Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

FEMAXI-IV is a computer code for the analysis of thermal and mechanical behavior of light water fuel rods during steady-state and transient conditions. It is an extension of the earlier version FEMAXI-III. In the new version, several models were improved and also new models were added. The most difference between the two versions exists in the fission gas release model. In FEMAXI-IV, the fission gas release model was thoroughly revised from the previous empirical model to the mechanistic model. In addition to the fission gas release model, the time dependent models were introduced for heat conduction and axial gas mixing of the released gas with the plenum gas in order to treat the fuel rod behavior during power transient. On the other hand, in the FEM mechanical analysis part, the one-dimensional FEM model was newly incorporated into FEMAXI-IV, in addition to the two-dimensional FEM model. In the one-dimensional FEM model, the integral mechanical behavior of a whole fuel rod is analyzed. FEMAXI-IV code calculations were compared with the experimental data obtained in the Halden Project and Studsvik power ramp experiments. This paper summarizes the models involved in FEMAXI-IV and the results of calculations on the experimental data. (author). 19 refs, 31 figs, 10 tabs.

5005 (IWGFPT–32, pp. 292-302) **Model for calculation of the fuel clad gap conductance.** Forsberg, K. (ABB Atom AB, Vaesteraas (Sweden). Fuel Div.); Massih, A.R. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

A model for calculation of heat transfer across the fuel-cladding gap in nuclear fuel element is presented. The model includes analytical expressions for the gap conductance that takes into account the stochastic variation of surface roughness of the fuel pellet and the cladding. In addition, the effect of fuel cracking and relocation that makes the pellet surface uneven is treated by arguments of mathematical statistics where appropriate mathematical expressions are put forward. A closed form solution of our model lends itself to a fast computational algorithm for a fuel rod performance simulator computer code. Comparisons are made between the prediction of gas conductance model and out-of-pile experiments, and the results are presented. The model has been implemented in the ABB ATOM integral fuel performance code STAV-6, and the code has been used to predict central fuel temperature data available from the Halden reactor. The agreement between model predictions and experimental data is satisfactory. (author). 19 refs, 8 figs, 4 tabs.

5006 (NUREG/CR–5406-Vol.2) **BWR reactor water cleanup system flexible wedge gate isolation valve qualification and high energy flow interruption test: Data report.** DeWall, K.G.; Steele, R. Jr. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; EG and G Idaho, Inc., Idaho Falls, ID (USA). Oct 1989. 717p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC07-76ID01570. (EGG–2569-Vol.2). Available from NTIS, PC A99/MF A01 - GPO; OSTI; INIS.

Volume II presents the measured test data from the gate valve test program described in Volume I. Figure 1 shows the test loop in schematic form and identifies the instrument location and numbers. Figure 2 converts the differential pressure measurement to gallons per minute. Table 1 outlines the test sequence performed on each valve and correlates the data as it is presented here. The header on each plot defines the valve A or B, the test series number, and the test step number. Table 2 lists the test parameters measured during blowdown tests, Test 3 lists the test step matrix for qualification and blowdown tests, and Table 4 lists the test steps and system pressure and temperature for each of the tests performed. 1405 figs., 4 tabs.

2102 Power Reactors, Nonbreeding, Light-Water Moderated, Nonboiling Water Cooled

Refer also to citation(s) 4783, 5002, 5003, 5004, 5125, 5126, 5127, 5129, 5144, 5145, 5147, 5152, 5153, 5156, 5157, 5161, 5162, 5164, 5173, 5177, 5178, 5179, 5184, 5187, 5189, 5197, 5200, 5202, 5206

5007 (AEEW-R–2143) **Experimental modelling of core debris dispersion from the vault under a PWR pressure vessel. Pt. 2: Results of including the instrument tubes support structure in the experiments.** Rose, P.W. UKAEA Atomic Energy Establishment, Winfrith (UK). Safety and Engineering Science Div. Dec 1987. 17p. Order Number DE90610957. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In previous experiments, done on a 1/25 scale model in Perspex of the vault under a PWR pressure vessel, the instrument tubes support structure built into the vault was not included. It consists of a number of grids made up of fairly massive steel girders. These have now been added to the model and experiments performed using water to simulate molten core debris assumed to have fallen on to the vault floor and high-pressure air to simulate the discharge of steam or gas from the assumed breach at the bottom of the pressure vessel. The results show that the tubes support structure considerably reduces the carry-over of liquid via the vault access shafts. (author).

5008 (CEGB-RD/B–6056/R88) **$^{10}B(n,\alpha)^{7}Li$ reaction in PWR coolants: calculations of the effect on coolant pH and on decreases in ^{10}B isotopic fractions.** Polley, M.V. Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs. Jul 1988. 32p. (PWR/CWG/P–(87)534;PWR/ASG/P–(87)5). Order Number DE90610165. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Boron is used as a chemical shim in PWRs for reactivity control and is added in the form of boric acid to the primary coolant. The $^{10}B(n,\alpha)^{7}Li$ reaction leads to a continuous increase in ^{7}Li in the primary coolant and to a continuous decrease in ^{10}B the isotope of boron responsible for control of reactivity. The rate of increase in coolant pH due to ^{7}Li production is calculated for the Sizewell 'B' PWR to enable judgements to be made on the frequency of sampling and removal of lithium required to maintain the pH of the primary coolant within the desired limits. Calculations are contrasted for the cases of natural boron and 100% ^{10}B chemical shims, for both a normal cycle and an extended 18 month cycle. Calculations of ^{10}B depletion over 30 years of operation as a function of the quantity of boron discharged to waste are also presented. ^{10}B isotopic fractions are calculated for the reactor coolant (RC), boric acid tanks (BATs) and refuelling water storage tank (RWST) assuming rapid mixing of BAT and RC boron for tritium control and other reasons. Such predictions enable assessments of the reactor physics implications of ^{10}B consumption to be made. (author).

5009 (CEGB-RD/B–6088/R88) **R6 validation exercise: through thickness residual stress measurements on an experiment test vessel ring.** Mitchell, D.H. Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs. Jun 1988. 18p. Order Number DE90610166. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A series of bursting tests on thick-walled pressure vessels has been carried out as part of a validation exercise for the CEGB R6 failure assessment procedure. The objective of these tests was the examination of the behaviour of typical PWR primary vessel material subject to residual stresses in addition to primary loading with particular reference to the R6 assessment procedure. To this end, a semi-elliptic part-through defect was sited in the vessel longitudinal seam, which was a submerged arc weld in the non stress-relieved condition; it was then pressure tested to failure. Prior to the final assembly of this vessel, a ring of material was cut from it to act as a test-piece on which a residual stress survey could be made. Surface measurements using the centre-hole technique were made by CERL personnel, and this has been followed by two through- thickness measurements at BNL using the deep-hole technique. This paper describes these deep-hole measurements and presents the results from them. (author).

5010 (CEGB-RD/L–3369/R88) **Implementation of a new bubbly-slug interphase drag model in RELAP5/MOD2.** Putney, J.M. Central Electricity Research Labs., Leatherhead (UK). Nov 1988. 31p. (PWR/HTWG/P–(88)622). Order Number DE90610167. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The implementation of a new bubbly-slug interphase drag model in the RELAP5/MOD2 code is described. The model is based on the determination of an effective interphase drag coefficient from a set of best-estimate void fraction correlations covering the full range of geometries and flow conditions encountered in PWR safety analysis. Calculations are reported which show that the new model leads to a much better prediction of void fraction profile for low flows in rod bundles than the standard model. Further work is necessary to derive a model formulation which can be guaranteed to produce physical drag coefficients in all flow situations. (author).

5011 (CEGB-RD/M–1717/RR88) **NUMAC-PWR: a PWR steam generator model for operational dynamics and control system studies.** Lightfoot, P.; Green, C.; Chojnowski, B. Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs. 1988. 17p. (CONF-8805226–: European two-phase flow group meeting, Brussels (Belgium), 30 May - 1 jun 1988; PWR/PKWG/P–(88)350). Order Number DE90608696. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

NUMAC-PWR is a dedicated PWR steam generator model for the analysis of operational transients and control system studies. It is being developed in support of the whole plant dynamic control system model SIBDYM. NUMAC-PWR solves the full one dimensional conservation equations for mass, energy and momentum in the main recirculation zone of the steam generator. A lumped parameter approach is utilised in the steam dome region. This paper summarises the model development and validation performed up until October 1987. Model comparisons are presented with steady state data from the Bugey-4 reactor, with steady state predictions of the French SICLE code, and with Belgian plant transient data. In all cases, NUMAC is shown to yield satisfactory agreement. (author).

5012 (CNEN-DR–108/81) **Power distribution and hot channel factor used in Angra 1 (W) and Angra 2,3 (KWU).** Fufier, E.B. Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1981. 58p. (In Portuguese). (GNT–08/81). Order Number DE90608644. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

In this report, the definition of hot channel factors and sub-factors used to quantify and qualify the nuclear power distribution and the thermal hydraulic performance of the core for KWU reactor (Angra 2 and 3) and Westinghouse (Angra 1), are presented. Some observations and comparisons are made in relation to the more important differences between criteria and models used in the determination of thermal hydraulic parameters. (author).

5013 (ETDE-IT–89-29) **Direct contact condensation in rectangular geometries: Experimental tests.** Celata, G.P.; Cumo, M.; D'Annibale, F.; Farello, G.E.; Focardi, G. ENEA, Casaccia (Italy). Centro Ricerche Energia. Dec 1987. 49p. (In Italian). Order Number DE90724689. Available from NTIS (US Sales Only), PC A03.

Relevant to the operation of nuclear power plant pressurizers and water-steam interactions safety analyses, an experimental investigation on the interaction between saturated and superheated steam in stagnant conditions and a subcooled liquid in horizontal flow in a rectangular channel is presented. A mathematical model is developed and its reliability to predict experimental results is discussed. A comparison of the values predicted by the model and experimental data shows that the model has a statistically significant degree of reliability.

5014 (ETDE-IT–89-31) **(PWR) Steam generators in accident conditions: secondary mass inventory - power exchange mapping.** Rizzo, V. ENEA, Casaccia (Italy). Centro Ricerche Energia. Nov 1987. 80p. (In Italian). Order Number DE90724711. Available from NTIS (US Sales Only), PC A05.

This report describes the testing of steam generator behaviour, during accidents (LOCA, PCM) and transients in Italian PWR-PUN plants. The aim of these tests was to characterize phenomena associated with the reduction of secondary mass and degraded thermal exchange. The test assembly employed simulated the Mod. F Westinghouse steam generator. Water and freon 12 were used as primary and secondary cooling fluids respectively. The primary temperature was varied from one test to another in order to map removed power at from 30 to 120% nominal power. For the calculation of secondary inventory, different test correlations were used based on a simplified hypothesis. The results obtained agreed well with measured values.

5015 (ETDE-IT–89-41) **SPES: PWR reactor test facility. Vol. 1. Facility description and instrumentation.** Cattadori, G.; Rigamonti, M. ENEA, Casaccia (Italy). Centro Ricerche Energia. 1987. 202p. Order Number DE90724712. Available from NTIS (US Sales Only), PC A10.

The approval, in 1981, of the Italian National Energy Plan which foresees the construction of PWR power stations for an overall power of 6000 MWe, convinced ENEA (Italian Commission for Nuclear and Alternative Energy Sources) to undertake an experimental programme in the field of safety. The main goal is the design and construction of an integral facility simulating the Italian PWR. This facility, named SPES (Simulazione PWR per esperienze di sicurezza), has the following aims: to maintain and increase knowledge in the field of safety related technology; to supply experimental results for accident analysis codes; to evaluate the effects of the operator intervention on the plant; to test possible plant modifications. SPES is designed to simulate thermal-hydraulic phenomena peculiar to SBLOCA's and operational transients. The same loop number as the reference reactor is obtained by maintaining the prototypical component elevations and by scaling core power and volume. This report (first of three volumes) describes SPES system philosophy, design, construction, instrumentation and data processing, and gives all the geometrical and physical data for safety computer code inputs. ENEA and USNRC (United States Nuclear Regulatory Commission) have finalized a cooperation contract regarding the exchange of computer codes and experimental data.

5016 (ETDE-IT–89-42) **SPES: PWR reactor test facility description. Vol. 2. Facility characterization.** Annunziato, A.; Rigamonti, M.; Vescovi, O. ENEA, Rome (Italy). Nov 1987. 73p. Order Number DE90724714. Available from NTIS (US Sales Only), PC A04.

In this second volume on the Italian SPES PWR simulator, the results of the facility characterization tests, i.e. pressure drops, heat losses and pumps performances, are reported. The SPES research program allows the participant in the OECD-CSNI International Standard Problem No. 22 to prepare the code input deck for the SP-FW-02 test, a loss of feedwater with delayed EFW actuation. This test is aimed to determine the time limit at which the emergency feedwater system must be actuated in order to prevent severe core damage.

5017 (ETDE-IT–89-43) **SPES: PWR test facility description. Vol. 3. Test specifications.** Annunziato, A.; Pignatelli, T. ENEA, Rome (Italy). Nov 1987. 39p. Order Number DE90724715. Available from NTIS (US Sales Only), PC A03/MF A01.

The SPES facility is a full power three loop scale model (scale factor 427.3) of the pressurized water reactor PWR-PUN plant selected for the Italian Energy Supply Plan. Within the framework of OECD-CSNI, Italy offers a test of loss of feedwater with delayed EFW actuation (International Standard Problem No. 22). The test is a loss of main feedwater in all three steam generators. Due to this initiating event, the level in the steam generator begins to drop very quickly . About some tens of seconds later the reactor scram signal is actuated by the low-low-level signal in one steam generator (1 out of 3). As consequence, the reactor is automatically shut down and the steam line is closed. The main purpose of the test is to study the response of the large system computer codes under the accidental conditions cited above. This third volume on SPES provides test specifications. A general test description, detailed information about system configuration, initial and boundary conditions, a list of the most significant quantities to be predicted and result presentation formats are reported in order to allow the participants to suitably carry out their calculations.

5018 (ETDE-IT–89-44) **SPES: PWR test facility. Appendix 1. Test data.** ENEA, Rome (Italy). 1987. 153p. Order Number DE90724716. Available from NTIS (US Sales Only), PC A08.

The SPES test facility is a full power three loop scale model (scale factor 427.3) of the pressurized water reactor PWR-PUN plant selected for the Italian Energy Supply Plan. Within the framework of OECD-CSNI, Italy offers a test of loss of feedwater with delayed EFW actuation (International Standard Problem No. 22). The test is a double blind and its main purpose is to study the response of the large system computer codes under the accidental conditions cited above. This appendix contains a collection of all the papers (with the exception of vol. 1 and 3) released during the First Workshop on the SPES Facility that took place in Piacenza (Italy, 17 Nov 1987). A detailed listing of the papers is reported. As new papers will be issued, this appendix is to be updated. Also, periodically, all the participants are to receive a report concerning any questions raised by the participants themselves about the test.

5019 (FURNAS-DPE-O–100) **Economic evaluation of three and four regions reactor core in Angra 1.** FURNAS, Rio de Janeiro, RJ (Brazil). Dept. de Planejamento Energetico. Jul 1974. 15p. (In Portuguese). Order Number DE90608698. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

An evaluation for Angra-1 reaction core with three and from regions aiming at several enrichments for the first core and the reactor fuelling for each case.

5020 (INIS-BR–1696) **Contribution to the study of the evolution of nuclear fuel composition in PWR type reactors. Reactor cores in three and four regions of enrichment.** Teixeira, M.C.C. Minas Gerais Univ., Belo Horizonte, MG (Brazil). 1976. 170p. (In Portuguese). Order Number DE90610950. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

The main methods for calculations of fuel depletion are studied and some approaches to do it are mentioned; the LEOPARD Code is described and full details are given for each subroutine, flow charts are included; the method given by the code for calculation of fuel depletion is described; some imperfections from the IPR's version are listed, and corrected, for instance: the method for burn-up calculation of heavy isotopes; the results of calculations for a reference reactor based on data of the Preliminary Safety Analysis Report (PSAR) for Angra I Nuclear Plant are presented and discussed. (author).

5021 (INIS-BR–1697) **Computer code to simulate transients in a steam generator of PWR nuclear power plants.** Silva, J.M. da. Instituto Militar de Engenharia, Rio de Janeiro, RJ (Brazil). 1979. 299p. (In Portuguese). Order Number DE90608699. Available from NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS.

A digital computer code KIBE was developed to simulate the transient behavior of a Steam Generator used in Pressurized Water Reactor Power PLants. The equations of Conservation of mass, energy and momentum were numerically integrated by an implicit method progressively in the several axial sections into which the Steam Generator was divided. Forced convection heat transfer was assumed on the primary side, while on the secondary side all the different modes of heat transfer were permitted and determined from the various correlations. The stability of the stationary state was verified by its reproducibility during the integration of the conservation equation without any pertubation. Transient behavior resulting from pertubations in the flow and the internal energy (temperature) at the inlet of the primary side were simulated. The results obtained exhibited satisfactory behaviour. (author).

5022 (INIS-BR–1707) **Sensitivity studies of some important parameters in the criticality of nuclear fuel pool.** Pina, C. Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1981. 17p. (In Portuguese). Order Number DE90608700. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The criticality study of spent fuels storage aiming to verify this security. A small description of the optimal moderation phenomena as well as the effect of stainless steel plates as neutron absorbed material, arre presented.

5023 (INIS-BR–1709) **Utilization of Quabox/Cubox computer program for calculating Angra 1 Reactor core.** Pina, C.M. de. Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1981. 38p. (In Portuguese). Order Number DE90608649. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The utilization of Quabox/Cubox computer codes for calculating Angra 1 reactor core is studied. The results shows a dependency between the spent CPU time and the curacy of thermal power distribution in function of the polinomial expansion used. Comparison were mode between Citation code and some results from Westinghouse.

5024 (INIS-mf–11562, pp. 10) **Effects of chemical regimen on corrosion product transport in primary circuit and on dose rates from primary circuit equipment.** Burclova, J. (Vyskumny Ustav Jadrovych Elektrarni, Trnava (Czechoslovakia)); Kukucova, M.; Ulicka, D.; Repas, R.; Dobis, L.; Vagner, F.; Streda, I. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. CORROSION PRODUCTS/ primary coolant circuits; DOSE RATES; RADIOACTIVITY; TEMPERATURE DEPENDENCE; WATER CHEMISTRY

5025 (INIS-mf–11562, pp. 11) **Monitoring of ^{3}H content in water effluents from Jaslovske Bohunice nuclear power plant complex.** Cechvala, L. (Krajska Hygienicka Stanica, Bratislava (Czechoslovakia)); Kollar, J. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. TRITIUM/hydrosphere; BOHUNICE A-1 REACTOR; BOHUNICE V-1 REACTOR; BOHUNICE V-2 REACTOR; DRINKING WATER; LIQUID WASTES; RADIOACTIVE EFFLUENTS; RIVERS; TRITIUM; HYDROSPHERE

5026 (INIS-mf–11562, pp. 34) **Experience with radiation protection during operation of Dukovany nuclear power plant.** Kopec, J. (Jaderna Elektrarna, Dukovany (Czechoslovakia)); John, A.; Hakl, J.; Zelenka, Z. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. DUKOVANY V-2 REACTOR/ radiation protection; RADIATION DOSES; RADIATION MONITORING; RADIOACTIVE EFFLUENTS; SAFETY; WORKING CONDITIONS

5027 (INIS-mf–11562, pp. 39) **Monitoring of beta radiation fields in nuclear power plant.** Lieskovsky, M. (Vyskumny Ustav Jadrovych Elektrarni, Trnava (Czechoslovakia)); Cerny, P. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number

DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

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5028 (INIS-mf–11562, pp. 54) **Protection of nuclear power plant personnel in elevated radiation risk work during extended overhaul.** Petrasova, M. (Krajska Hygienicka Stanica, Bratislava (Czechoslovakia)); Viktory, D.; Hutta, J. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. BOHUNICE V-1 REACTOR/repair; REPAIR/radiation protection; REPAIR; PERSONNEL; RADIATION DOSES

5029 (INIS-mf–11562, pp. 65) **Design of monitoring system for hypothetical radiation accident of Temelin nuclear power plant.** Singer, J. (Jaderna Elektrarna, Temelin (Czechoslovakia)); Koc, J.; Benes, M.; Cvetkov, C. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. RADIATION MONITORING/planning; TEMELIN-1 REACTOR/radiation monitoring; DOSIMETRY; ORGANIZING; PLANNING; REACTOR ACCIDENTS

5030 (INIS-mf–11563, pp. 142-154) **Use of the Blahutovice (North Moravia) nuclear power plant for district heating of the Ostrava region.** Valasek, J.; Kalab, J.; Mazac, V.; Seidl, F.; Ostrolucky, J.; Rozehnal, V. Ceskoslovenska Vedeckotechnicka Spolecnost, Prague (Czechoslovakia). Dum Techniky. 1988. (In Czech). (CONF-8809397–: 7. international district heating conference, Prague (Czechoslovakia), Sep 1988). In *VII international district heating conference.* Order Number DE90608686. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Published in 3 volumes.

Project variants were detailed for supplying heat from the Blahutovice nuclear power plant to the Ostrava region, Czechoslovakia. This area is characterized by a thermal input of around 3,600 MW with an annual heat consumption of 36,000 TU. Approximately 50% power and 75% consumption should be provided by the nuclear power plant. Project variants design differed by the number and routes of the supply pipes, the choice of territorial units, the operation mode of the nuclear power plant with regard to the amount of heat supply, and by the cooperation between the nuclear power plant and the local fossil fuel burning sources. The economically most beneficial project design proceeds from the series-parallel cooperation between the nuclear power plant and the local sources. This variant also puts lowest demands on fossil sources which is ecologically favourable. According to this project the nuclear power plant supplies heat to the whole area through which the heat supply pipe passes, i.e., including localities which are closest to and most affected by the nuclear power plant. Briefly discussed are factors which were taken into consideration, namely: the size of the integrated district heating system, cooperation of fossil burning sources with the nuclear source within the system, supply of heat during refuelling in the nuclear power plant, optimization of the diameter of the heat supply pipes and the effect of the heat supply pipes operating reliability. (Z.M.). 1 fig.

5031 (INIS-mf–11563, pp. 179-193) **Design project of supplying Prague with heat and water from the Temelin nuclear power plant.** Havelka, Z. Ceskoslovenska Vedeckotechnicka Spolecnost, Prague (Czechoslovakia). Dum Techniky. 1988. (In Czech). (CONF-8809397–: 7. international district heating conference, Prague (Czechoslovakia), Sep 1988). In *VII international district heating conference.* Order Number DE90608686. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

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The possibilities were studied of supplying heat from the Temelin nuclear power plant to Prague which represents the transport of heat to a distance of more than 100 km. The problems were addressed of transferring and distributing heat in Prague by hot water, of providing the necessary water and its treatment for the single-tube hot water heating system at the Temelin nuclear power plant. Attention was also given to alternative possibilities of heat supply from 1000 MW steam turbines and the design of transfer heat exchange stations with cooling systems to reduce the temperature of the hot water to less than 20 degC, as well as to designs for using cooled heat exchange water (following its treatment in the secondary network for utility water) in industry and for other purposes. Supplies of heat from the Temelin nuclear powser plant to Prague were expected to increase from 1500 MW in the year 2000 to the maximum output of 2700 MW after the year 2020. The hot water system with water having a maximum temperature of 180 degC should initially be operated as a semi-open system, in the following stage as a closed system with return water cooling. The results of the economic calculation show that capital costs should not exceed 15 thousand million Czechoslovak crowns to make the investment profitable. (Z.M.). 6 figs., 1 tab., 4 refs.

5032 (INIS-mf–11563, pp. 205-210) **Heat extraction from the Jaslovske Bohunice nuclear power plant to supply Leopoldov and Hlohovec.** Hajducik, O.; Zeman, J. Ceskoslovenska Vedeckotechnicka Spolecnost, Prague (Czechoslovakia). Dum Techniky. 1988. (In Slovak). (CONF-8809397–: 7. international district heating conference, Prague (Czechoslovakia), Sep 1988). In *VII international district heating conference.* Order Number DE90608686. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

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Two variant projects were designed for the extraction of 240 MW of heat from the V-1 nuclear power plant in Jaslovske Bohunice to the Leopoldov and Hlohovec areas. The aim is to meet the requirements for district heating in the two towns and the electric power requirements of the Slovlik food manufacturing enterprise in Leopoldov in the following forms: steam 0.4 MPa, 70 MW for technological purposes, hot or warm water 28 MW for heating. A detailed description is presented of the two variants with regard to heating technology. The criterion for selecting the better variant was simplicity of concept and higher guarantee of operating reliability, also the amount of capital cost which is 467 million Czechoslovak crowns for the first variant and 499 million for the second. (Z.M.). 1 fig.

5033 (INIS-mf–11563, pp. 211-231) **Use of the Temelin nuclear power plant for heat supply to the South Bohemia region.** Kadlec, J.; Sejda, V.; Varenka, J. Ceskoslovenska Vedeckotechnicka Spolecnost, Prague (Czechoslovakia). Dum Techniky. 1988. (In Czech). (CONF-8809397–: 7. international district heating conference, Prague (Czechoslovakia), Sep 1988). In *VII international district heating conference.* Order Number DE90608686. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

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A detailed report is presented on the results of studies dealing with the use of the Temelin nuclear power plant for providing district heating to the South Bohemian region of Czechoslovakia. This creates pre-conditions for the use of this power plant for heating, for the adequate utilization of nuclear fuel and for increasing the overall heat effect of the cycle in this nuclear power plant, the reduction in the use of fossil fuels, labor saving, reducing the emissions of flue ash and sulfur oxides into the atmosphere. Heat output is supposed to be extracted from the power plant in form of water 153/67 degC hot for the own consumption of the nuclear power plant, and for supplying the area of Tyn nad Vltavou and the western and northern areas of the region. Hot water (temperature 183/67 degC) will

be supplied to Ceske Budejovice and Zliv and the possibility of supplying hot water for agriculture and the fisheries is also considered. The temperatures of water supplied to these two industries would be 153/67 degC and 80/40 degC, respectively. Attention is also paid to the control of the heating system, including the establishment of a central heating control for the region system. (Z.M.). 5 figs.

5034 (INIS-mf–11563, pp. 290-304) **Efficiency of district heating of Brno by the Dukovany nuclear power plant.** Kobosil, J. Ceskoslovenska Vedeckotechnicka Spolecnost, Prague (Czechoslovakia). Dum Techniky. 1988. (In Czech). (CONF-8809397–: 7. international district heating conference, Prague (Czechoslovakia), Sep 1988). In *VII international district heating conference.* Order Number DE90608686. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

Published in 3 volumes.

Providing heat to the town of Brno from the Dukovany nuclear power plant will require a reconstruction of the nuclear power plant in the years 1992 - 1995 for district heating. The existing regeneration heaters will be replaced by dual-purpose heaters which at the temperature gradient of 142/70 degC will allow to obtain from each turbine a heat output of 85 MW., i.e., a total of 680 MW. In the second stage after the year 2000 an increase in the temperature gradient to 156/70 degC will allow the overall heat output to be increased to 840 MW. The length of the heat supply pipe between the nuclear power plant and the outskirts of the town of Brno is 42 km and at will mainly be built on the surface. So far no final decision has been taken as to the diameter of the pipes (1,000 mm or 1,200 mm). When the pipes reach the outskirts of the town they will by-pass Brno in the north-west direction which will provide heat distribution using diversely laid 500 - 800 mm pipes to the existing system of district heating. A detailed description is presented of the economic analysis made from the enterprise point of view, i.e., an analysis of production costs of heat generation. Considering the aspect of economic benefit applying existing regulations, the given ensemble of structures is slightly unprofitable. (Z.M.). 2 figs., 5 tabs., 2 refs.

5035 (INIS-mf–11563, pp. 478-491) **SKODA steam turbines for cogeneration of electric power and heat in Czechoslovak fossil-fuel and nuclear power plants.** Drahy, J. Ceskoslovenska Vedeckotechnicka Spolecnost, Prague (Czechoslovakia). Dum Techniky. 1988. (In Czech). (CONF-8809397–: 7. international district heating conference, Prague (Czechoslovakia), Sep 1988). In *VII international district heating conference.* Order Number DE90608686. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

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Briefly characterized is the concept of special turbines by SKODA for the heating operation. Attention is also devoted to the reconstruction and updating of steam turbines which were originally designed as pure condensation turbines, to condensation-extraction or back-pressure turbines. This reconstruction is being carried out to meet the needs of individual power plants, after the life-span of the relevant parts has expired. In nuclear power plants with WWER-440 reactors and 220 MW saturated steam turbines, the turbines are envisaged to be used for the combined generation of electric power and heat, this observing the diverse extraction demands of the respective locality. The 1,000 MW saturated steam turbine, 3,000 r.p.m. is designed for a maximum heat extraction of 893 MW at three stage water heating to 60/150 degC. At the Temelin nuclear power plant with 1,000 MW units, heat supply will not reach the rated maximum. 306 MW of heat is required at three stage water heating to 65/150 degC. Full heat extraction will be implemented in nuclear power plants with 1,000 MW reactor units which are to be built in eastern Slovakia. (Z.M.). 1 fig., 1 ref.

5036 (INIS-mf–11563, pp. 492-501) **Use of nuclear power sources for district heating in Czechoslovakia.** Darilek, J.; Zlatnansky, J. Ceskoslovenska Vedeckotechnicka Spolecnost, Prague (Czechoslovakia). Dum Techniky. 1988. (In Czech). (CONF-8809397–: 7. international district heating conference, Prague (Czechoslovakia), Sep 1988). In *VII international district heating conference.* Order Number DE90608686. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

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The development of district heating in Czechoslovakia is to be based on the combined generation of electric power and heat with the use of nuclear sources. The requirements for district heating are to increase from roughly 560 thousand TU in 1985 to 648 thousand TU in the year 2005. Nuclear sources are to provide 54 thousand TU by 2005. Economic analyses show that heat supply from nuclear power plants, i.e., production costs of this supply are considerably less than with sources fuelled by natural gas, heating oil and coal. In long-term perspective, nuclear heating plants are also considered for this purpose, this in areas outside of the technical and economic reach of the district heating system. At present, AST heating plants with an output of 500 MW are planned to become an alternative source for some localities where heat cannot be supplied from nuclear power plants (Bratislava, Ostrava). The construction and operation of a greater number of nuclear heating plants with an output smaller than 300 MW are considered for a number of localities roughly to the year 2010. The benefit is also studied of nuclear power plants with outputs ranging between 2 and 20 MW. (Z.M.).

5037 (INIS-mf–11563, pp. 907-918) **Projecting large heat supply systems in Czechoslovakia.** Machacek, I. Ceskoslovenska Vedeckotechnicka Spolecnost, Prague (Czechoslovakia). Dum Techniky. 1988. (In Czech). (CONF-8809397–: 7. international district heating conference, Prague (Czechoslovakia), Sep 1988). In *VII international district heating conference.* Order Number DE90608686. Available from NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS.

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The development of district heating in Czechoslovakia is at present oriented to the establishment of regional heating systems. Existing condensation power plants which are the present sources are gradually being converted into power and heat plants. The use of medium and low-potential heat from nuclear power plants is also being considered as these plants will be the main sources of heat for large district heating systems after the year 2000. Analyzed are experiences with the project design of selected structures of heat supply pipes for the heating systems in Prague, Brno, Kolin and Havirov. The Dukovany nuclear power plant will supply heat to the town of Brno. The implementation of this project which is to take place in 1995, will save around 200 million m^3 of natural gas, 115 thousand tons of brown coal and 11 thousand tons of mazut. For the first stage, a heat output of 635 MW is envisaged at a temperature gradient of 140/70 degC, in the second stage, heat output will increase to 880 MW at the temperature gradient of 156/70 degC. The heat supply pipe from the Dukovany nuclear power plant to the outskirts of the town of Brno is 42.2 km long, pipes have an alternative diameter of 2x1000mm or 2x1200mm. The total length of the branches which by-pass the town and provide the interconnection of the heat source with the existing district heating system is 15.4 km, pipe diameter ranges from 350 to 800 mm. Total capital costs are 2.2 thousand million crowns for the basic variant with a pipe of 2x1000 mm in diameter. (Z.M.).

5038 (INIS-mf–11564) **Thermal physics 84. Thermal aspects of WWER nuclear reactor safety. V. 2. Collection of papers from CMEA seminar, Varna, October 1984.** Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1985. 319p. (CONF-8410495–: Thermal physics '84: thermal aspects of WWER nuclear reactor safety, Varna (Bulgaria), Oct 1984). Order Number DE90705979. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

Individual papers in this collection are separately indexed.

5039 (INIS-mf–11564, pp. 1-11) **Critical heat flux density in 19-rods cluster of I.V.Kurchatov Institute of atomic energy. Experiment and calculation comparison.** Wolter, W. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1985. (In Russian). (CONF-8410495–:). In *Thermal physics 84. Thermal aspects of WWER nuclear reactor safety. V. 2. Collection of papers from CMEA seminar, Varna, October 1984.* Order Number DE90705979. Available from NTIS (US Sales Only), PC A14/MF A01; INIS.

Experiments on heat transfer crisis have been carried out in Kurchatov IAE with a subcooled boiling in a 19-rods cluster with high

radial peaking factor (k equale 1.83) of power density. The experimental data were then processed with QUEKAS code. In each case the cluster critical power has been determined via variation of the input power up to the point where in a hot channel the heat transfer crisis started. The thermal- hydraulic calculations by QUEKAS code, taking into consideration the turbulent mixing according to Slutsker method as well as the cross-flow (resulting in uniform pressure distribution across the cluster) are in a good agreement with the experimental results which is demonstrated ty the presented data. 4 refs.; 4 tabs.; 2 figs.

5040 (INIS-mf–11564, pp. 12-20) **Critical heat flux study on WWER-1000 fuel rod assembly models.** Wolter, W. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1985. (In Russian). (CONF-8410495–:). In *Thermal physics 84. Thermal aspects of WWER nuclear reactor safety. V. 2. Collection of papers from CMEA seminar, Varna, October 1984.* Order Number DE90705979. Available from NTIS (US Sales Only), PC A14/MF A01; INIS.

Experimental results of a heat transfer crisis study are presented. The experiments were conducted an a 7-rods cluster with uniform power density distribution both across the radius and length of the cluster. The coolant pressure has been varied from 15.5 up to 18.0 MPa and the mass flow rate from 2400 up to 3800 kg/m^{2}s. The cluster consisted of 7 electrically heated rods with 9.0 mm diameter. In the rod tops channels of 3.0 mm diameter and 45 mm length had been drilled for placing thermocouples that were used for registering the moment of heat transfer crisis onset. The rod pitch in the lattice was 13 mm, the cluster cross-section was 646 mm^2 with hydraulic diameter of 8.11 mm, thermal diameter of 13.04 mm, the heated section length of 3500 mm and the total cluster length of 6450 mm. The experiments have been carried out on Large water test facility at SHKODA Power engineering plant (Plsen', Czechoslovakia). The thermal parameter ranges and the model geometry corresponded to those of WWER-1000 reactor. The obtained experimental data are compared with calculated ones. The systematic mean arithmetic error for an experimental series was 23.9%. The thermal load variations during crisis onset revealed by the temperature jumps did not exceed 3.47% and were of not so clearly expressed systematic nature. 4 refs.; 4 figs.

5041 (INIS-mf–11564, pp. 21-42) **Heat transfer crisis calculation for boiling in fuel rod clusters taking into account the elementary cell thermohydraulics.** Wolter, W. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1985. (In Russian). (CONF-8410495–:). In *Thermal physics 84. Thermal aspects of WWER nuclear reactor safety. V. 2. Collection of papers from CMEA seminar, Varna, October 1984.* Order Number DE90705979. Available from NTIS (US Sales Only), PC A14/MF A01; INIS.

PUCHOK BM-DF code is described which is designated for local thermal-hudraulic parameters calculations in rod clusters with large rod numbers (300 and more) using the cell method. In this code iterations are applied for the convective crossflow mixing calculation. For the turbulent heat transfer description several empirical correlations are employed the choice among which can be done by the user. On the basis of the calculated cell thermohydraulic parameters numerous experimental data on the heat transfer crisis in various test facilities have been analyzed including those with high length. A good agreement between the calculated and experimental data allows to recommend with a high degree of reliability the cell method realized in RUCHOK BM-DF code for the fuer rod performance analysis in clusters of high length. 12 refs.; 10 figs.

5042 (INIS-mf–11564, pp. 43-65) **Calculation results for the heat transfer crisis conditions during fast transient processes.** Wolter, W. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1985. (In Russian). (CONF-8410495–:). In *Thermal physics 84. Thermal aspects of WWER nuclear reactor safety. V. 2. Collection of papers from CMEA seminar, Varna, October 1984.* Order Number DE90705979. Available from NTIS (US Sales Only), PC A14/MF A01; INIS.

The impact of axial power distribution, heat transfer across the fuel/cladding gap and various correlations on the calculations of boiling crisis has been studed for transient regimes connected with the reactivity variations. The simulated transient was characterized by the power versus time curve that corresponded to the control rod bundle shot-out at the following core nominal initial parameters: p = 12.3 MPa, T = 270 grad.C, G = 2700 kg/(m^{2}s). Selection of decreased values of the heat transfer coefficient for the gap resulted in an earlier boiling crisis onset or attaining the minimum critical/actual heat flux density ratio. A comparison is made for Osmachkin's and Bezrukov's correlations employment to the critical heat flux density calculations. 6 refs.; 3 tabs.; 9 figs.

5043 (INIS-mf–11564, pp. 66-71) **Heat transfer crisis in non-stationary coolant flow.** Wolter, W. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1985. (In Russian). (CONF-8410495–:). In *Thermal physics 84. Thermal aspects of WWER nuclear reactor safety. V. 2. Collection of papers from CMEA seminar, Varna, October 1984.* Order Number DE90705979. Available from NTIS (US Sales Only), PC A14/MF A01; INIS.

Experimental study results for transient critical heat flux density are presented in the parameter range corresponding to the crisis states of WWER type reactors. The critical heat flux densities were measured on an electrically heated fuel rod cluster simulator that consisted of 7 parallel tubes with 10x0.5 mm diameter. The tubes were placed with relative pitch of 1.4 in a channel with the internal diameter of 46 mm. Both axial and radial power density distribution was uniform, the heated length amounted to 1200 mm. The experiments were carried out at two levels of pressure, 12.5 and 26 MPa. The mass flow rate variation was about 1140 kg/(m^{2}s) that corresponded to WWER-1000 reactor state with one of four main circulation pumps stopped. The obtained results are compared with those calculated with the use of various correlations. For the given rate of the coolant flow variation the critical heat flux densities did not differ from those abtained for the stationary flow. 6 refs.; 1 tab.; 1 fig.

5044 (INIS-mf–11564, pp. 72-84) **Mass and heat transfer inhancement in channels with turbulizers.** Wolter, W. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1985. (In Russian). (CONF-8410495–:). In *Thermal physics 84. Thermal aspects of WWER nuclear reactor safety. V. 2. Collection of papers from CMEA seminar, Varna, October 1984.* Order Number DE90705979. Available from NTIS (US Sales Only), PC A14/MF A01; INIS.

The experimental study results are presented for the liquid distribution between the tube flow core and the film on the wall as well as for the heat transfer crisis in tubes with a single turbulator in the form of a corrugated insert. The experiments have been carried out on a test facility with freon-12 as a coolant. The experimental section incorporated a tube with 8 mm inner diameter with two independently heated zones of different length. Between these the turbulator had been placed. At the second zone outlet an annular slot type chamber had been envisaged for measuring the liquid flow rate in the film. The impact of the heat flux density, the distance from the insert, the mass flow rate on the liquid distribution between the flow core and the film has been studied. The obtained results were generalized by empirical correlations. On the basis of the single corrugated insert study a method for calculation of the heat transfer crisis in channels with turbulators has been suggested. The root-mean-square error of the critical heat flux density calculation was 15% while that of the critical power was twice lower. 3 refs.; 7 figs.

5045 (INIS-mf–11564, pp. 85-99) **Calculation of spacer hydraulic resistance in WWER type reactors and its impact on the flow within rod clusters.** Wolter, W. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1985. (In Russian). (CONF-8410495–:). In *Thermal physics 84. Thermal aspects of WWER nuclear reactor safety. V. 2. Collection of papers from CMEA seminar, Varna, October 1984.* Order Number DE90705979. Available from NTIS (US Sales Only), PC A14/MF A01; INIS.

A new single-phase model of a spacing grid for the subchannel analysis application is described. Comparing the calculated values

of pressure difference, flow rate redistribution and grids interaction with the experimental data the following conclusions can be drawn. The model with local hydraulic resistance at the place of the grid location corresponding to the irreversible pressure loss due to grid is improper for the discription of the pressure difference and flow rate redistribution in the vicinity of the grid. The new model gives a good agreement with the experimental data. The calculations for the fuel rod cluster of WWER-440 type show a nonhomogeneous pressure field near the spacing grid. 9 refs.; 1 tab.; 7 figs.

5046 (INIS-mf–11564, pp. 115-128) **Post critical heat transfer study.** Wolter, W. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1985. (In Russian). (CONF-8410495–:). In *Thermal physics 84. Thermal aspects of WWER nuclear reactor safety. V. 2. Collection of papers from CMEA seminar, Varna, October 1984.* Order Number DE90705979. Available from NTIS (US Sales Only), PC A14/MF A01; INIS.

Post-CHF experimental study results obtained within the range of WWER-type reactor working parameters are presented. The experimental section incorporated a 7-rod bundle with direct uniform heating. The rods were made of stainless steel in the form of tubes with 9.1 mm outer diameter and 0.5 mm wall, the heated length of 1.75 m, the triangular lattice pitch of 12.75 mm, the 'spanner' size of the hexagonal channel was 35.5 mm. The rod bundle had full-scale spacing grids placed at 250 mm from each other. For temperature measuring some thermocouples were arranged within the tubes contacting the surface through an insulating layer. The experiments have been carried out within the following parameter range: pressure - 13.8-15.8 MPa, mass flow rate - 2000-3400 kg/(m^2s), heat flux density - 1.1-2.95 MW/(m^2), relative outlet enthalpy - 0-0.2, wall temperature - less 700 grad.C. The heat transfer calculation error was within 2.4% (film boiling) to 40% (nucleate boiling). Two levels of the heat flux density were determined: one corresponding to heat transfer crisis onset and another to attaining the wall temperature of 550-600 grad.C. It was found out that the heat flux density resulting in the mentioned temperature rise exceeded the critical level by 10-15% at the given coolant enthalpy. The actual heat flux (power) rise at a constant inlet enthalpy and attaining 600 grad.C was 7-10%. The obtained results show that short-time transitions to post-critical heat transfer regimes being permissible provides an additional thermal reliability reserve for the reactor core. 8 refs.; 7 figs.

5047 (INIS-mf–11564, pp. 129-140) **Thermal non-equilibrium and heat removal in the area of hindranced heat transfer in a steam generating channel.** Wolter, W. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1985. (In Russian). (CONF-8410495–:). In *Thermal physics 84. Thermal aspects of WWER nuclear reactor safety. V. 2. Collection of papers from CMEA seminar, Varna, October 1984.* Order Number DE90705979. Available from NTIS (US Sales Only), PC A14/MF A01; INIS.

A step model has been used for determination of empirical coefficients included into correlations employed in thermal non-equilibrium calculations. A great number of experimental points covering a wide range of the regime parameters has been assessed. An empirical correlation based on the calculated data for the steam real mass content is suggested. After calculating the steam real mass content the channel temperature regime can be found from the known relations. A comparison is presented with the data obtained on a channel with cosine power density distribution across its height. A good agreement is emphasized not only for the temperature regime but for the steam real mass content calculated by the authors with the use of their two-step method either. The suggested correlation can be used for the fuel rod temperature regime calculations in case of accidents with the heat transfer crisis onset. 15 refs.; 1 tab.; 5 figs.

5048 (INIS-mf–11564, pp. 158-165) **Heat transfer crisis investigation on 19-rod cluster with high peaking factor of power density.** Wolter, W. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1985. (In Russian). (CONF-8410495–:). In *Thermal physics 84. Thermal aspects of WWER nuclear reactor safety. V. 2. Collection of papers from CMEA seminar, Varna, October 1984.* Order Number DE90705979. Available from NTIS (US Sales Only), PC A14/MF A01; INIS.

Experimental data on the heat transfer crisis in a 19-tubes bundle with the radial power density nonuniformity coefficient of 1.828 are presented. The tubes with 9 mm outer diameter were arranged in staggered order with 12.2 mm pitch. The bundle heated length was 2.5 m. The averaged values of the calculated/experimental critical heat flux density ratio for unidimensional approximation were found to be 1.545, 1.067 and 0.87 in case of the optimistic estimate, the mean estimate for an imaginary 'hot' bundle and the mean estimate for a 'hot' subchannel respectively. These results have been obtained when calculating the critical thermal loads with the use of the steam consent in the critical cross-section. When calculating was based on the experimental values of the coolant inlet subcooling those ratios were 1.340, 1.035 and 0.94 respectively. The obtained calculation data has shown both unidimensional mean estimates to provide satisfactory results. The critical heat flux density calculations were performed on VEVERKA code. The average calculated/experimental critical heat flux density ratio was found to be 0.9. 5 refs.; 1 tab.; 2 figs.

5049 (INIS-mf–11564, pp. 166-188) **Liquid phase boundaries and average temperature in thermally nonequilibrium two-phase flow in steam-generating tubes.** Wolter, W. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1985. (In Russian). (CONF-8410495–:). In *Thermal physics 84. Thermal aspects of WWER nuclear reactor safety. V. 2. Collection of papers from CMEA seminar, Varna, October 1984.* Order Number DE90705979. Available from NTIS (US Sales Only), PC A14/MF A01; INIS.

Boundaries of the thermally non-equilibrium two-phase flow in steam-generating tubes have been experimentally established and the flow liquid phase temperature measured. During the experiments the flow temperature distribution across the steam-generating tube was measured with the use of movable thermocouples. The experiments have been performed on tubes with 12 and 22 mm inner diameter, of 1600 and 4500 mm length respectively, within the ranges: 3.0-18 MPa of pressure, 500-3000 kg/(m^2s) of mass flow rate, 0.25-3.0 MW/(m^2) of heat flux density. Recommendations on the boundary relative enthalpy and liquid phase mean temperature for the thermally non-equilibrium flow are given. 10 refs.; 12 figs.

5050 (INIS-mf–11564, pp. 189-202) **Theoretical description of two-phase flow in the primary circuit of AST-500 heat surrly reactor.** Wolter, W. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1985. (In Russian). (CONF-8410495–:). In *Thermal physics 84. Thermal aspects of WWER nuclear reactor safety. V. 2. Collection of papers from CMEA seminar, Varna, October 1984.* Order Number DE90705979. Available from NTIS (US Sales Only), PC A14/MF A01; INIS.

The paper deals with the problems of theoretical modelling of two-phase flow in the core and riser section of AST-500 reactor. A two-phase model realized in FLOCAL code is presented that has been developed for this purpouse but is actually employed in a wider area. This model has been used for a methodical study of thermal-physical effects. Calculations performed for non-stationary regimes revealed coolant flow rate oscilations that were interprited as a dynamic instability with density waves. The oscilations arrearance and amplitude depend in the first instance on the steam weight content at the core outlet. An oscilation amplitude decrease was observed with the power reduction and the rise of hudraulic resistance at the channel inlet at fixed steam content levels. The established stability conditions are in a good agreement with the published data. 4 refs.; 2 tabs.; 5 figs.

5051 (INIS-mf–11564, pp. 269-279) **Investigation of long term variations in heat transfer crisis margin on B-1 NPP.** Wolter, W. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1985. (In Russian). (CONF-8410495–: Thermal physics '84: thermal aspects of WWER nuclear reactor safety, Varna (Bulgaria), Oct 1984). In *Thermal physics 84. Thermal aspects of WWER nuclear reactor safety. V. 2. Collection of papers*

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A method is described for investigation of long-term heat-transfer crisis margin variations with the use of the reactor control instrumentation. The measurement interval of about 50 effective days of operation has been adopted. The measured values of the core inlet temperature, the coolant pressure and the reactor power were averaged over several subsequent measurements. The axial distribution of neutron flux (power density) has been measured in 12 core channels. The obtained distributions were approximated by polynoms of the 5-th power and related to certain fuel rod bundles. The investigation results collected during 4 campaigns of operation of the first V-1 NPP unit and 3 campaigns of the second one are presented. The method and some results of the described study have been employed for developing algorithms for the assessment of the reactor core thermal reliability during NPP operation. 4 refs.; 4 figs.

5052 (INIS-mf–11564, pp. 233-243) **Comparison of various calculation models for subcooled boiling with experimental data.** Wolter, W. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1985. (In Russian). (CONF-8410495–:). In *Thermal physics 84. Thermal aspects of WWER nuclear reactor safety. V. 2. Collection of papers from CMEA seminar, Varna, October 1984.* Order Number DE90705979. Available from NTIS (US Sales Only), PC A14/MF A01; INIS.

The paper presents the results of a comparative methodical study of various subcooled liquid boiling models with the use of experimental data from literature. The study was carried out on FLOSTA code with the purpose of choosing a suitable method for calculating the subcooled coolant boiling under the conditions of AST-500 reactor. A conclusion has been drawn about applicability under those conditions of Molochnikov's and Plutinskij-Fishgojt's non-equilibrium models. 8 refs.; 6 figs.

5053 (INIS-mf–11564, pp. 244-263) **Numerical solution of one-dimensional hydrodynamic equations.** Wolter, W. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1985. (In Russian). (CONF-8410495–: Thermal physics '84: thermal aspects of WWER nuclear reactor safety, Varna (Bulgaria), Oct 1984). In *Thermal physics 84. Thermal aspects of WWER nuclear reactor safety. V. 2. Collection of papers from CMEA seminar, Varna, October 1984.* Order Number DE90705979. Available from NTIS (US Sales Only), PC A14/MF A01; INIS.

Some methods have been investigated for obtaining approximate one-dimensional equations of compressible single/two-phase medium hydrodynamics neglecting the acoustic effects. Such an approach allows to produce sufficiently effective (as compared with the general problem) algorithms which are not limited by strict requirements of stability and convergence and less sensitive to the mass/energy disbalances both for explicite and difference schemes. A short discription of algorithms realized in codes for PWR nonstatinary regime calculations is given. Test calculation results are presented for the natural convection flow rate variation in a water cooled simulator mockup at a given power variation time dependence and for a leakage flow rate variation in time in a model hydrodynamic task. 5 refs.; 7 figs.

5054 (INIS-mf–11564, pp. 264-268) **Reactor thermal power determination as guarantee testing of WWER-440 unit.** Wolter, W. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1985. (In Russian). (CONF-8410495–:). In *Thermal physics 84. Thermal aspects of WWER nuclear reactor safety. V. 2. Collection of papers from CMEA seminar, Varna, October 1984.* Order Number DE90705979. Available from NTIS (US Sales Only), PC A14/MF A01; INIS.

The determination of a reactor thermal power is one of the established guarantee tests. Since exact measuring of the primary circuit coolant flow rate is impossible a method of reversed balance is used that is based on measuring the energy transfered into the secondary circuit, the primary circuit losses and the power of odditional heat sources within the primary circuit. The development of the reversed balance method is described for WWER-440 reactor conditions. The steam generator power measuring system has been made specially for the guarantee tests on the basis of sensors and instrumentation of high accuracy installed together with the ordinary control and instrumentation equipment. The measurements of total primary circuit thermal losses are performed during start-up operations when the reactor is being heated up with turning on various number of the main circulation pumps. The prepared measurings of the reactor thermal power can be considered as a large power experiment which is to produce accurate data for verification of the codes that are used for preparing the safety reports on NPPs with WWER type reactors. 2 refs.

5055 (INIS-mf–11564, pp. 280-294) **Δp type flowmeter calibration for coolant flow rate measuring in NPP primary circuit.** Wolter, W. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1985. (In Russian). (CONF-8410495–:). In *Thermal physics 84. Thermal aspects of WWER nuclear reactor safety. V. 2. Collection of papers from CMEA seminar, Varna, October 1984.* Order Number DE90705979. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

The determination of coolant flow rate via measuring the pressure drop in a pipe wherein no developed flow can exist (e.g. in the NPP primary circuit piping) requires some calibration. A method is described for such a case when a direct calibration is not feasible. Since simulation of surface nonuniformity is a rather complicated task the experimental mockup consists of an investigated pipe and a straight section for determining the friction coefficient. Knowing the latter the pipe hydraulic resistance coefficient can be found. During experiments a wide range of Reynolds numbers has been investidated for an air flow discharged from a high pressure vessel. It was shown that the pressure drop measured along a pipe can be used for determining the flow rate in pipes of various shape after preliminary calibration. 3 refs.; 5 figs.

5056 (IWGFPT–32, pp. 50-56) **Qualification and interpretation of MR test reactor irradiation data on WWER-440 type fuel rods for fuel thermal model validation.** Yakovlev, V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Strijov, P.; Murashov, V.; Senkin, A.; Teraesvirta, R.; Liuhto, P.; Moisio, J.; Tiihonen, O.; Kelppe, S.; Ranta-Puska, K. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

Conducted jointly by the Kurchatov Institute of Atomic Energy of the USSR and the Finnish state owned power utility Imatran Voima Oy, an irradiation program, SOFIT, including a series of characterised and instrumented test rod bundles is in progress to examine the thermal and mechanical behaviour of WWER type fuel rods. The main purposes of the work are to promote the flexibility and the economy of the fuel utilisation, and to verify, for the WWER annular fuel and Zr1%Nb cladding, the fuel behaviour computer programs used in the Soviet Union and in Finland. The more specific objectives are to obtain information on fuel temperature, internal gas pressure and cladding elongation during irradiation for different fabrication parameters. Qualification and interpretation of in-pile results from the first irradiation, completed at maximum local exposure of about 16 MWd/kgU, are presented. Quantitative evaluation of affecting phenomena could be deduced from the restored thermocouple readings. The measured temperatures show dependency on the as-fabricated gap size and weakness on the helium fill pressure. The results of the calculations, obtained by the existing steady state fuel behaviour computer codes are compared with the experimental temperatures. The importance of careful qualification of the data is emphasised. The related uncertainties are discussed. Preliminary fission gas data of some of the rods have become available, which show low or moderate gas release. (author). 5 refs, 7 figs, 1 tab.

5057 (IWGFPT–32, pp. 66-70) **Performance analysis of WWER-1000 type fuel rods up to high burnups in steady state conditions.** Carl, H. (Zentralinstitut fuer Kernforschung, Rossendorf (German Democratic Republic)); Reinfried, D.; Steinkopff, H. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

Out of different possibilities to improve the fuel utilization in PWR increasing burnup by means of extension of exposure time of fuel rods has been used in many countries for some years. In future it is intended to extend the exposure time of fuel rods up to 900 days and more in the WWER-1000. By means of burnup calculations carried out for this mode of operation peak values for the mean and local burnup of a fuel rod have been found to be about 45 GWd/tU and 50 GWd/tU, respectively. In this paper the results of model calculations on the operating performance of this fuel rod using the computer code STOFFEL-1 are presented and discussed. (author). 8 refs, 4 figs, 1 tab.

5058 (IWGFPT–32, pp. 102-108) **Fragema PCI modelling and its utilization in the MISTIGRI computer code.** Joseph, J. (Fragema, 69 - Lyon (France)); Blasco, C.L.; Daudin, L. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

The new operating modes used in French PWR's, together with new fuel management strategies and enhanced core performances, lead to higher fuel loadings and make it necessary to conduct a detailed analysis of the effects of pellet/cladding interaction (PCI) on fuel behaviour. Thus FRAGEMA has been led to develop analytical methods together with high-performance design tools. PCI is the result of several complex phenomena which include both oxide and cladding behaviour. The conjunction of these phenomena may lead to Stress Corrosion Cracking. To study the effects of PCI, it was therefore necessary to integrate special models into a larger-scale model system, which gave rise to the final PCI rupture model. It incorporates the mechanical effects in the claddings and the chemical effects giving rise to SCC and causing the initiation and propagation of cracks in the Zircaloy. The stresses during transients are governed by the cold pellet/cladding gap, which is dependent on in-reactor irradiation conditions. Local stresses at the pellet interfaces are calculated by means of a finite element method. Times to rupture are calculated by a model which calls upon fracture mechanics concepts. A stress criterion was determined from power ramp experiments. It sets a rupture limit; the time to rupture has to be calculated if the criterion is exceeded, such that a safe operating lifetime is established. This is determined by means of an SCC model. The models are qualified with the experimental results obtained in CEA laboratories, among others. The model was operated in the MISTIGRI computer code, which allows fast, economical analysis of PCI effects on the fuel under all possible operating conditions. The MISTIGRI code was input into a computer system which includes core physics models. A number of fuel performance analyses are underway or have been completed. (author). 15 refs, 9 figs.

5059 (IWGFPT–32, pp. 109-115) **Mechanisms affecting PCI/SCC at high burnup.** Haas, D. (Societe Belge pour l'Industrie Nucleaire, Brussels (Belgium)); Billaux, M.; Falla, A. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

This paper presents the sensitivity study performed with the COMETHE-3L and its new version COMETHE-4. The COMETHE-4 code version contains new high burn-up models. The mechanisms operative under high burn-up conditions and influencing the stress magnitude were evaluated. The conclusion reached from these evaluations is that the modification of the cladding properties, cladding creep and cladding oxidation, have a greater influence than the modification of the fuel properties. (author). 4 refs, 6 figs, 1 tab.

5060 (IWGFPT–32, pp. 143-151) **D-COM blind problem on fission gas release: Further experimental results and calculations with TRANSURANUS.** Walker, C.T. (Commission of the European Communities, Karlsruhe (Germany, F.R.). European Inst. for Transuranium Elements); Lassmann, K.; Coquerelle, M.; Mogensen, M. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

The concentration of retained xenon, the percentage of porosity and the grain size have been measured as a function of radial position in the base irradiated rod AG11-8 and the transient tested rod AG11-10. The results show that in the base irradiation, densification of the fuel took place, no detectable gas release occurred and that slight grain growth occurred at the pellet centre. During the transient test, 15-20% of the xenon inventory was released from the fuel grains. Gas release was accompanied in the central region of the fuel by an increase in the porosity from 4.7% to 6-8%. These findings are compared with predictions made by the fuel performance code TRANSURANUS. The code predictions are in good agreement with the experimental observations. (author). 14 refs, 11 figs, 2 tabs.

5061 (IWGFPT–32, pp. 159-168) **Fission gas release modelling: Developments arising from instrumented fuel assemblies, out-of-pile experiments and microstructural observations.** Leech, N.A. (UKAEA Northern Research Labs. Windscale, Seascale (UK)); Smith, M.R.; Pearce, J.H.; Ellis, W.E.; Beatham, N. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

This paper reviews the development of fission gas release modelling in thermal reactor fuel (both steady-state and transient) and in particular, illustrates the way in which experimental data have been (and continue to be) the main driving force behind model development. To illustrate this point various aspects of fuel performance are considered: temperature calculation, steady state and transient fission gas release, grain boundary gas atom capacity and microstructural phenomena. The sources of experimental data discussed include end-of-life fission gas release measurements, instrumented fuel assemblies (e.g. rods with internal pressure transducers, fuel centre thermocouples), swept capsule experiments, out-of-pile annealing experiments and microstructural techniques applied during PIE. In the case of the latter, the benefit of applying many observation/analysis techniques on the same fuel samples (the approach adopted at NRL-Windscale) is stressed. This illustrates a shift of emphasis in the modelling field from the development of large, complex thermo-mechanical computer codes to the

assessment of key experimental data in order to develop and evaluate sub-models which correctly predict the observed behaviour. (author). 26 refs, 7 figs, 1 tab.

5062 (IWGFPT–32, pp. 169-174) **Improved version of the PIN code and its verification.** Strijov, P. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Yakovlev, V.; Dubrovin, K.; Pazdera, F.; Valach, M.; Barta, O. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

A short description of the PIN-04M code intended for the light water power reactor fuel rod behaviour modelling under quasi-steady-state operating conditions is given. The present code version includes new dependences over previous one for thermal conductivity of a fuel produced by home technology and for N-1 alloy (zirconium + 1% niobium) cladding creep. To verify the code prediction ability the comparison was performed of calculation results with the data of in-pile and postirradiation research carried out at the Kurchatov Institute of Atomic Energy. It was shown that the PIN-04M code is in a close agreement with experimental values for the fuel centreline temperature, internal gas pressure and amount of fission gases released under rod cladding, which makes it possible to draw a conclusion on the applicability of the PIN-04M code for modelling a behaviour of WWER type fuel rods. The results of calculations on optimization of initial value for an internal gas pressure in fuel rods of WWER-440 reactor with increased power are given as an example. (author). 8 refs, 5 figs, 1 tab.

5063 (IWGFPT–32, pp. 182-186) **Production of helium in UO_2-PuO_2 mixed oxide fuel.** Billaux, M. (Societe Belge pour l'Industrie Nucleaire, Brussels (Belgium)); Lippens, M.; Boulanger, D.; Nidifi, H. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

A neutronic module called IRIS has been developed and incorporated into the fuel rod behaviour computer code COMETHE. It calculates the evolution of 80 isotopes along the pellet radius and in each axial node of a fuel column: 14 actinides, 65 fission products and helium. The classical linear matrix differential equation is solved by the "method of the chains". This one consists in splitting up the system of equations into a limited number of partial systems easy to solve. This allows to avoid the research of the eigenvalues and of the eigenvectors of large matrix operators at each point of space and time. This method was compared with the classical methods of resolution of the burnup equations and was found to be far faster and to give more stable results. WIMS-LWR shows that the spectral effects along the pellet radius are important and must be taken into consideration at least in the calculation of the build-up of Pu239. When completely linked with the other models of COMETHE, IRIS will allow to calculate: (1) the evolution of the radial power profile in the pellets up to high burnups; (2) the krypton and xenon source terms in the fission gas release model; (3) the local fuel properties (fuel conductivity, diffusion coefficient of the gas atoms, ...), considering the detailed fuel composition; (4) the helium production and release, and its contribution to the rod inner pressure. The latter point was first investigated. The interpretation of a series of puncturing results of UO_2 and UO_2-PuO_2, mixed oxide (MOX) rods showed that the helium production is far more important in MOX fuel than in UO_2. A good consistency has been found between the postirradiation examination results and the calculation. That comparison allowed to estimate the helium release from the fuel and to establish a relation between the release of helium and that of xenon and krypton.

5064 (IWGFPT–32, pp. 221-228) **Analysis of the mechanisms involved in fission gas release during power transients at high burnup.** Charles, M. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Inst. de Recherche Technologique et de Developpement Industriel (IRDI)); Simmons, J.; Lemaignan, C. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

In order to obtain information on the kinetics of fission gas release during power transients at high burnup, a sweeping gas experiment has been recently performed (joint programme between EDF, FRAMATOME and CEA) on a standard FRAGEMA fuel rod irradiated up to 35 $Gwd.tu^{-1}$ in a PWR. A short length of the rod was reirradiated in the Siloe pool reactor at Grenoble, up to 40.6 $Gwd.tu^{-1}$ at a steady-state power level of 20 $kW.m^{-1}$ with 10 moderate transients. This experiment has been described in detail elsewhere. The fission gas release (FGR) results suggested that fission gases accumulate during steady-state irradiation on grain boundaries; during power changes, intergranular cracks are induced, allowing gas to be released. This scheme is quantified by estimations given in the case of stable gases only. Two stages are explored: gas arrival at grain boundaries (with radiation-induced gas re-solution from bubbles), and formation of a crack network. Commonly admitted values of relevant parameters are used (diffusion coefficient, re-solution parameter, re-solution distance) and a value for crack specific surface area is deduced from the fuel macrographs obtained during PIE. In order to derive a consistent description, it is found necessary to consider a possible contribution of gas bubbles interconnected with bubbles of the crack surface and/or importance of micro-cracking. Further, the effect of high burnups upon the above parameters and also upon the saturation threshold of grain-boundaries by fission gases has to be considered. (author). 34 refs, 6 figs.

5065 (IWGFPT–32, pp. 234-241) **Analysis of fuel behaviour under SB-LOCA for Qinshan NPP and some problems encountered in using RELAP5/MOD1, FRAPCON-2 and FRAP-T6 codes.** Zhang Yingchao (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy). International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

Recently at the Institute of Atomic Energy (IAE), RELAP5/MOD1, FRAPCON-2, and FRAP-T6 have been linked for analyzing the fuel behavior under Small-Break Loss of Coolant Accident (SB-LOCA) conditions for Qinshan Nuclear Power Plant (Qinshan NPP) which is under construction in China. The main results are quite reasonable, but some problems have been found in combining the functions of different codes, for example, when using the initial conditions provided by FRAPCON-2, FRAP-T6 gives incredibly large cladding stress at the beginning of the accident. It is suggested that for these codes some further improvements are desirable. (author). 4 refs, 8 figs, 2 tabs.

5066 (IWGFPT–32, pp. 241-247) **Zircaloy oxidation kinetics in the temperature range 700-1300 deg. C.** Haste, T.J. (UKAEA Northern Research Labs., Springfields (UK)); Harrison, W.R.; Hindle, E.D. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance

and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

The oxidation of Zircaloy-4 cladding is an important phenomenon in the course of postulated PWR loss-of-coolant accidents, affecting the deformation response of the rods in the refill/reflood phases (700-900 deg. C), and the mechanical integrity of the cladding if higher temperatures are reached later in the transient. Above about 1050 deg. C the kinetics of oxide layer growth are well described by parabolic rate laws, while below about 900 deg. C the kinetics follow approximately cubic behaviour. The present paper describes the formulation of an empirical power law model, based on comprehensive KfK Karlsruhe measurements, which quantifies the above behaviour. These data are compared with Springfields measurements of oxide layer growth for three other batches of Zircaloy in steam and helium/oxygen atmospheres. The model is used to examine the variation in oxidation kinetics found both amongst the batches, and between the oxidising atmospheres employed. This work was partly funded by the Central Electricity Generating Board under the Thermal Reactor Agreement. (author). 7 refs, 6 figs, 1 tab.

5067 (IWGFPT–92, pp. 247-266) **Extension and assessment of th cladding ballooning model in the FRAP-T6 code.** El-Adham, K.A. (Nuclear Regulatory and Safety Centre, Cairo (Egypt)). International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

The FRAP-T6 code was extended to calculate: (a) fuel surface azimuthal temperature distribution; (b) work done on cladding by internal pressure; and (c) azimuthal heat conduction in the cladding. The extensions were assessed by comparing calculated and measured cladding ballooning characteristics for four in-pile fuel rod tests. The assessment showed that the calculation of the fuel surface azimuthal temperature distribution improved the calculations of cladding ballooning. Both calculations and experimental results indicate that coplanar blockage due to cladding ballooning is unlikely during a large break LOCA. (author). 13 refs, 39 figs, 7 tabs.

5068 (IWGFPT–92, pp. 269-278) **Controlling overall fission gas release by controlling axial gas mixing.** Kjaer-Pedersen, N. (Studsvik of America, Inc., San Rafael, CA (USA)); Mogard, H. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

Fission gas release in an operating water reactor fuel rod may be stimulated by the thermal feedback mechanism, i.e. the mutual enhancement of fuel temperatures and local free volume concentration of heavy gases. Furthermore, under fuel-cladding mechanical interaction, portions of the fuel stack may be prevented from axial gas exchange. In such regions, thermal feedback may be especially pronounced. Hence, if axial resistance to gas mixing could be eliminated, overall gas release might be significantly reduced. A new fuel rod design, the "Rifled Cladding" design, has been developed at STUDSVIK, in which the cladding inner surface is prismatic. When fuel-cladding mechanical interaction occurs with this type of fuel, contact is restricted to the mid portions of the prismatic faces, leaving axial channels of triangular cross-section open at each corner-line. Together with the ring-shaped volumes formed by pellet chamfering, these axial channels form a gas communication grid that tends to remain open at all power levels. This design has been tested in the STUDSVIK R2 reactor. The experiments, which involved ramping to 50-60 kW/m, showed large reductions of gas release for rifled cladding rods, relative to conventional rods subjected to the same experimental conditions. The experiments also showed a considerable increase in failure threshold for rifled cladding rods. The experiments have been modeled by the INTERPIN code. Calculations showed gas release values for rifled cladding rods that were 2.5 times lower than for conventional rods. Furthermore, the calculated maximum cladding stress was reduced by 33% as a result of the absence of thermal feedback. The present paper briefly reports the experimental findings, then describes the modeling principles used in INTERPIN to explain the results.

5069 (IWGFPT–92, pp. 286-291) **Thermal response to inert gas mixing in the fuel clad gap of operating rods.** Killeen, J.C. (Institutt for Energiteknikk, Halden (Norway). OECD Halden Reaktor Projekt); Haaland, A. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

A series of experiments has been undertaken using IFA-504, a gas flow assembly in the Halden Reactor. The aim of the experiments has been to determine the rate at which different inert gases will intermix in the fuel-clad gap of an operating fuel rod. Three different types of experiment have been carried out. In the first two, argon was introduced to the gap whilst a plenum region was left filled with helium. The rate of intermixing with two distinct initial filling conditions was followed. In the final tests the assembly was uprated so that the gap became contaminated with released fission product xenon, and the rate of dilution of this gas with helium from the plenum regions of the fuel pin was observed. In all cases the rate of inert gas mixing was determined from measured fuel centreline temperatures which were affected by the change in gap thermal conductance due to the changing inert gas composition in the gap. The results show that the kinetics of gas mixing can be described by a simple one dimensional model of inert gas interdiffusion, where the diffusion path length is typically three times the geometric distances within the rod. (author). 3 refs, 9 figs, 2 tabs.

5070 (NUREG/CR–5327) **Slow strain rate testing of a cyclically stabilized A 516 Gr. 70 piping steel in PWR conditions.** Hanninen, H.E. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Metals Lab.); Cullen, W.H. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Materials Engineering Associates, Inc., Lanham, MD (USA). Nov 1989. 48p. Sponsored by Nuclear Regulatory Commission. (MEA–2265). Available from NTIS, PC A04/MF A01 - GPO; OSTI; INIS.

In fatigue, both monotonic and cyclic plastic zones are formed ahead of the crack tip, inside which the strain history can be studied on the basis of stable hysteresis loops and their development. A 516 Gr. 70 piping steel was prefatigued to represent the material structure anticipated in the process zone and in the area of the maximum tensile stress ahead of the crack-tip. With these materials, slow strain rate tests were performed both in bulk PWR-environments and in the simulated crack-tip environments (MnS-contaminated water). Environment-sensitive cracking occurred in the simulated crack tip environments and in tests where external polarization was used to polarize the specimens to 0.0 mV(SHE) in both the MnS-contaminated and pure PWR-water. No marked difference was observed between as-received material and prefatigued materials. Usually the residual hydrogen content of the gage length section was increased after SSRT-testing, but based on the limited number of tests no clear conclusions could be drawn. 39 refs., 18 figs., 6 tabs.

5071 (STUK-B-YTO–48) **Operation of Finnish nuclear power plants. Quarterly report 3. quarter 1987.** Haenninen, R. and others (comp.). Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland). Dept. of Nuclear Safety. Jun 1988. 25p. Order Number DE90610185. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This general review of the operation of the Finnish nuclear power plants concentrates on such events and discoveries related to nuclear and radiation safety as the regulatory body, the Finnish Centre for Radiation and Nuclear Safety, regards as noteworthy. The report also includes a summary of the radiation safety of the personnel and the environment, as well as tabulated data on the production and load factors of the plants. In the report period, no event essentially degraded plant safety nor posed a radiation hazard to the personnel o the environment.

5072 (UFRJ-COPPE-GAPS–02/83) **Reliability analysis of air recirculation and refrigeration systems of Angra-1 reactor containment: a reevaluation.** Oliveira, L.F.S. de; Fleming, P.V.; Frutuoso e Melo, P.F.F. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1983. 48p. (In Portuguese). Order Number DE90608740. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A realiability analysis of the air refrigeration and recirculation containment systems (ARRCS) of Angra-1 nuclear power plants, were done, aiming to evaluate the probabilities of occurence of a several accident. The systems were analysed for a 24 hours accident, including time failures and demand failures.

5073 (UFRJ-COPPE-GAPS–03/83) **Reliability analysis of the service water system of Angra 1 reactor.** Oliveira, L.F.S. de; Fleming, P.V.; Frutuoso e Melo, P.F.F.; Tayt-Sohn, L.C. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1983. 93p. (In Portuguese). Order Number DE90608741. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

A reliability analysis of the service water system is done aiming to use in the evaluation of the non reliability of the component cooling system (SRC) for great loss of cooling accidents in nuclear power plants. (E.G.).

5074 (UJV–8734-M) **Fuel rod expert system.** Barta, O.; Novak, L.; Pazdera, F. Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia). Jan 1989. 16p. Order Number DE90608742. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Information is given on the Fuel Rod Expert System (FRES), developed for the WWER-440 power units. The system consists of two partially independent parts (i.e. fuel rod damage probability prediction and fuel rod evaluation), which enable: (1) to optimize the operating flexibility from the point of view of minimization of fuel rod damage probability by pellet-cladding interaction during transients; (2) to evaluate cladding integrity of fuel rods during reactor operation and to predict and partially optimize radiation set-ups during transients; and (3) to obtain probability distribution of the fuel rod damage. The FRES software package was installed at the Dukovany nuclear power station as a part of a standard information system. (author). 7 figs., 6 refs.

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Refer also to citation(s) 5111, 5143, 5149, 5165, 5261, 5263, 5407, 5409, 5515, 5732, 5819, 5830

5075 (CEGB-RD/B–6080/R88) **Radioactive inventory of a Dungeness 'A' heat exchanger.** Hancock, R. Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs. Nov 1988. 16p. Order Number DE90610191. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Detailed engineering plans for the decommissioning of the earliest nuclear plant in the United Kingdom, the steel pressure vessel Magnox reactors, are being developed. Stage two of the decommissioning will involve dismantling and removal of all buildings and structures external to the reactor concrete bioshield. This report concerns stage two and is part of the generic studies which have concentrated on Dungeness A power station as being typical of the earliest of the steel pressure vessel Magnox reactors in having the heat exchangers external to the concrete bioshield. The heat exchangers will thus be included in stage two decommissioning, to which they contribute the largest mass of contaminated material. The purpose of the report is to bring together all the available data, obtained as part of the generic decommissioning programme, on the contamination in the heat exchangers at Dungeness A power station and to recommend a database from which the options for disposal of heat exchangers may be formulated. (author).

5076 (CEGB-RD/M–1780/RR89) **Scaled Lagrangian method for performing a least squares fit of a model to plant data.** Crisp, K.E. Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs. 1988. 8p. Order Number DE90610192. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Due to measurement errors, even a perfect mathematical model will not be able to match all the corresponding plant measurements simultaneously. A further discrepancy may be introduced if an unmodelled change in conditions occurs within the plant which should have required a corresponding change in model parameters - e.g. a gradual deterioration in the performance of some component(s). Taking both these factors into account, what is required is that the overall discrepancy between the model predictions and the plant data is kept to a minimum. This process is known as 'model fitting'. A method is presented for minimising any function which consists of the sum of squared terms, subject to any constraints. Its most obvious application is in the process of model fitting, where a weighted sum of squares of the differences between model predictions and plant data is the function to be minimised. When implemented within existing Central Electricity Generating Board computer models, it will perform a least squares fit of a model to plant data within a single job submission. (author).

5077 (GA-A–19618) **Shutdown cooling helium circulator design considerations for MHTGR [Modular High Temperature Gas-Cooled Reactor] power plant.** McDonald, C.F. General Atomics Co., San Diego, CA (USA). Jul 1989. 8p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC03-89SF17885. (CONF-891208–8: Winter annual meeting of the American Society of Mechanical Engineers, San Francisco, CA (USA), 10-15 Dec 1989). Order Number DE89014318. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The Modular High Temperature Gas-Cooled Reactor (MHTGR) plant embodies a shutdown cooling system to expedite plant cooldown for refueling, maintenance, and repair in the event that the main cooling loop is unavailable. This is a non safety related system. A key component in this system, is a helium circulator. Oriented vertically, the rotating assembly in this machine is supported on active magnetic bearings, and the radial flow compressor is driven by a submerged induction electric motor rated at 160 kW(e). This paper gives details of the circulator design considerations and includes topics related to the machine operation and maintenance, and the technology base. 12 refs., 11 figs., 3 tabs.

5078 (IWGGCR–19) **Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.** International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989. 188p. (CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

At the invitation of the Government of the USA the Technical Committee Meeting on Design Requirements, Operation and Maintenance of Gas-Cooled Reactors, was held in San Diego on September 21-23, 1988, in tandem with the GCRA Conference. Both meetings attracted a large contingent of foreign participants. Approximately 100 delegates from 18 different countries participated in the Technical Committee meeting. The meeting was divided into three sessions: Gas-cooled reactor user requirement (8 papers); Gas-cooled reactor improvements to facilitate operation and maintenance (10 papers) and Safety, environmental impacts and waste

disposal (5 papers). A separate abstract was prepared for each of these 23 papers. Refs, figs and tabs.

5079 (IWGGCR–19, pp. 9-13) **Utility/user requirements for the modular high temperature gas-cooled reactor.** Boyer, V.S. (Gas-Cooled Reactor Associates, San Diego, CA (USA)); Kendall, J.M.; Gotschall, H.L. International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989. (CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). In *Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.* Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

This paper describes the approach used by Gas-Cooled Reactor Associates (GCRA) in developing Utility/User Requirements for the Modular High Temperature Gas-cooled Reactor (MHTGR). As representatives of the Utility/User industry, it is GCRA's goal that the MHTGR concept be established as an attractive nuclear option offering competitive economics and limited ownership risks. Commercially deployed MHTGR systems should then compete favorably in a mixed-fuel economy with options using fossil, other nuclear and other non-fossil sources. To achieve this goal, the design of the MHTGR plant must address the problems experienced by the U.S. industrial infrastructure during deployment of the first generation of nuclear plants. Indeed, it is GCRA's intent to utilize the characteristics of MHTGR technology for the development of a nuclear alternative that poses regulatory, financial and operational demands on the Owner/Operator that are, in aggregate, comparable to those encountered with non-nuclear options. The dominant risks faced by U.S. Utilities with current nuclear plants derive from their operational complexity and the degree of regulatory involvement in virtually all aspects of utility operations. The MHTGR approach of using ceramic fuel coatings to contain fission products provides the technical basis for simplification of the plant and stabilization of licensing requirements and thus the opportunity for reducing the risks of nuclear plant ownership. The paper describes the rationale for the selection of key requirements for public safety, plant size and performance, operations and maintenance, investment protection, economics and siting in the context of a risk management philosophy. It also describes the ongoing participation of the Utility/User in interpreting requirements, conducting program and design reviews and establishing priorities from the Owner/Operator perspective. (author). 7 refs, 1 fig.

5080 (IWGGCR–19, pp. 14-17) **Requirements for electricity producing gas-cooled reactors in the Federal Republic of Germany.** Schwarz, D.K.J. (Vereinigte Elektrizitaetswerke Westfalen A.G. (VEW), Dortmund (Germany, F.R.)). International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989. (CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). In *Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.* Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

The paper describes requirements to a high-temperature gas-cooled reactor from the view-point of a utility in the Federal Republic of Germany. The requirements presented in the paper address different areas including plant size, availability, safety and economics. (author).

5081 (IWGGCR–19, pp. 17-23) **Utility/user requirements for the MHTGR desalination plant.** Brown, S.J. (Gas-Cooled Reactor Associates, San Diego, CA (USA)); Snyder, G.M. International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989. (CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). In *Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.* Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

This paper describes the approach used by Gas-Cooled Reactor Associates (GCRA) and the Metropolitan Water District of Southern California (MWD) in developing Utility/User (U/U) Requirements for the Modular High Temperature Gas-cooled Reactor (MHTGR) Desalination Plant. This is a cogeneration plant that produces fresh water from seawater, and electricity. The U/U requirements for the reference MHTGR plant are used except for those changes necessary to: provide low-grade heat to a seawater desalination process, enable siting in a Southern California coastal area, take advantage of reduced weather extremes where substantial cost reductions are expected, and use seawater cooling instead of a cooling tower. The resulting requirements and the differences from the reference MHTGR requirements are discussed. The nuclear portion of the design is essentially the same as that for the reference MHTGR design. The major differences occur in the turbine-generator and condenser, and for the most part, the design parameters for the reference plant are found to be conservative for the desalination plant. The most important difference in requirements is in the higher seismic levels required for a Southern California site, which requires reassessment and possible modification of the design of some reference plant equipment for use in the desalination plant. (author). 5 refs, 1 tab.

5082 (IWGGCR–19, pp. 24-29) **Process heat supply requirements on HTGRs.** Schad, M.K. (Lurgi GmbH, Frankfurt am Main (Germany, F.R.)). International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989. (CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). In *Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.* Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Since it has been claimed that the MHTGR is competitive with coal in producing electricity, the MHTGR must be competitive in producing process heat. There is a huge process heat market and there are quite a number of processes where the industrial MHTGR = HTRI could supply the necessary process heat and energy. However, to enhance its introduction on the market and to conquer a reasonable share of the market, the HTRI should fulfill the following major requirements: Unlimited constant and flexible heat supply, no secondary heat transport system at higher temperatures and low radioactive contamination level of the primary helium. Unlimited constant and flexible heat supply could be achieved with smaller HTRIs having heat generation capacities below 100 MW-th. The process heat generated by smaller HTRIs need not be more expensive since the installed necessary heat supply redundancy is smaller and the excess power density lower. The process heat at elevated temperatures generated by a HTRI with a secondary heat transfer system is much more expensive due to the additional investment and operating cost as well as the reduced helium temperature span available. For some processes, the HTRI is not able to cover the total process heat requirement while other processes can consume only part of the heat offered. These limitations could be reduced by using higher core outlet and inlet temperatures or both. Due to the considerably lower heat transfer rates and the resulting larger heat transfer areas in process plants, the diffusion of nuclear activity at elevated temperatures may increase so that a more efficient helium cleaning system may be required. (author). 5 figs, 3 tabs.

5083 (IWGGCR–19, pp. 30-35) **Factors influencing selection of a HTR for a developing country.** Karim, C.S. (Bangladesh Atomic Energy Commission, Dhaka (Bangladesh). Nuclear Power and Energy Div.). International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989.

(CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). In *Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.* Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Consumption of commercial energy and electricity in Bangladesh has to grow rapidly in order to attain socio-economic development of the country. Nuclear power is considered to be an appropriate proposition due to the inadequacy of indigenous primary energy resources. A technical, economic and financial feasibility study of a 300-500 MWe nuclear power plant is underway now. Responses from different suppliers in SMPR range were enumerated jointly by the Consultants and BAEC under the feasibility study. Criteria for selection of technology and the factor influencing the selection of Modular HTR for Bangladesh are described in the paper. Some indicative results of cost economic calculations are included to help form an idea about various limiting conditions, under which a SMPR with the selected technology could become competitive with the other conventional alternatives. Problems in decision making associated with the uncertainties in estimating plant and fuel cycle costs are enumerated. The implications of not having a reference plant vis-a-vis the advantageous safety features are described to show how these aspects can influence the selection of a new technology like HTR for a developing country. Financing is identifiable as the major problem in implementing a nuclear power project in a developing country like Bangladesh. The entire scope of supplies and services may be broken down into components, so that the burden of financing could be shared by more than one exporting country. Some indicative ideas about the packaging of supplies and services are presented in the paper in order to identify different types of financing sources that could be explored for implementation of the project. Some salient features of the effect of joint-venture on the project financing and implementation are described in the paper. (author). 3 refs, 1 fig.

5084 (IWGGCR–19, pp. 38-42) **Status of the HTR research and development programme in China.** Xu Yuanhui (Institute of Nuclear Energy Technology, Beijing (China)). International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989. (CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). In *Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.* Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

In the seventh Five Year Plan China has identified various high priority research areas which also include development work for the High-Temperature Gas-Cooled Reactor. For the coordination of technology development contributions from different institutes an expert team was appointed by the State Scientific Technology Commission. The paper contains description of HTGR relevant research and development work and the main data of the HTGR test module planned for construction at the Institute of Nuclear Energy Technology. (author). 3 figs, 3 tabs.

5085 (IWGGCR–19, pp. 55-61) **Fort Saint Vrain operational experience.** Fuller, C.H. (Public Service Co. of Colorado, Denver, CO (USA)). International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989. (CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). In *Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.* Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Fort St. Vrain (FSV), on the system of the Public Service Company of Colorado, is the only high temperature gas-cooled (HTGR) power reactor in the United States. The plant features a helium-cooled reactor with a uranium-thorium fuel cycle. The paper describes the experience made during its operation. (author). 2 refs, 4 figs, 2 tabs.

5086 (IWGGCR–19, pp. 61-70) **Present state of the HTR concept based on experience gained from AVR and THTR.** Wachholz, W. (Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (Germany, F.R.)). International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989. (CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). In *Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.* Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

During the past ten years the development of a specific HTR concept has made remarkable progress. This has been mainly characterized by making use of the safety characteristics typical of the High-Temperature Reactor (HTR). In the design, construction and operation of High-Temperature Reactors - especially AVR (15 MWe plant in Juelich, FRG) and THTR (300 MWe plant in Hamm-Uentrop, FRG) - comprehensive experience has been gained in the field of operational availability and safety, accident topology and plant risk of HTRs in recent years. This experience is relevant for the entire HTR line independent of specific projects. (author). 3 refs, 5 figs, 1 tab.

5087 (IWGGCR–19, pp. 71-79) **Technology development for the modular high-temperature gas-cooled reactor.** Homan, F.J. (Oak Ridge National Lab., TN (USA)); Turner, R.F. International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989. (CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). In *Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.* Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

In the USA the Modular High-Temperature Gas-Cooled Reactor is in an advanced stage of design. The related HTGR program areas, the approaches to these programs along with sample results and a description of how these data are used are highlighted in the paper. (author). Figs and tabs.

5088 (IWGGCR–19, pp. 86-96) **Status of development of the HTR module.** Weisbrodt, I.A. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bergisch Gladbach (Germany, F.R.)). International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989. (CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). In *Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.* Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Growing concern about the rising global temperature of the earth due to the "Greenhouse Effect" is increasingly focussing worldwide interest on passively safe reactors for heat and power production. In this context the development status of the HTR-Module designed by the Siemens-Group merits strong interest. The HTR-Module has a high degree of passive safety features. Even in case of hypothetical accidents the decay heat is dissipated from the primary system to the environment by passive measures alone i.e. by heat conduction, convection and radiation. The detailed engineering for the HTR-Module continues to progress. In addition to the engineering for the layout considerable progress has been made in the detailed engineering for specific components - e.g. pressure vessel, steam generator, hot gas duct, blower etc. - and specific systems - e.g.

first core, helium purification system, reactor safety system, reactor control etc. The procedure for the conceptual licence has been continued. A large number of supplementary analyses and reports have been elaborated and submitted for this procedure. Many workshop meetings have been held with the nominated experts. The hypothetical accidents have been analysed and a special report on these accidents has been submitted. The safety analyses report has been revised, taking into account the results and achievements reached during the ongoing licensing procedure. Parallel to these engineering activities outstanding in R and D work for the HTR-Module, e.g. in the field of fuel elements etc. has been continued. The HTR-Module has found worldwide interest. Respective activities are going on in Bangladesh, PR China, USSR, Indonesia etc. Relevant application studies have been carried out and/or initiated. (author). 15 refs, 16 figs.

5089 (IWGGCR–19, pp. 96-103) **Small demonstration HTGR concept.** Kiryushin, A.I. (Gor'kovskij Politekhnicheskij Inst., Gorki (USSR)). International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989. (CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). In *Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.* Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Currently the USSR is investigating two high-temperature gas-cooled reactors. The first plant is the VGM, a modular type HTGR with power rating of 180-250 MWth. The second plant is the VG-400 with 1000 MWth and a prestressed concrete reactor vessel. The paper contains the description of the VGM design and its main components. (author). 1 fig., 1 tab.

5090 (IWGGCR–19, pp. 35-38) **High temperature gas cooled reactors in China.** He Jiachen (Ministry of Nuclear Industry, Beijing, BJ (China)); Qian Jihui. International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989. (CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). In *Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.* Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

China has plentiful energy resources, but it is unevenly distributed geographically. 60% of coal resources are in North China, 71% of hydro-power resources in the hardly accessible Southwest China, whereas the densely populated and highly industrialized 15 provinces/municipalities along the coast, yielding 73% of the GNP, possess only 10% of national energy resources, which makes our railway system hard pressed. About 40% of the railway transport and 50% of the main waterway transport are committed to fuel. Yet the energy needs in the coastal regions cannot be met. Nuclear power is a natural approach to solving energy problems in China, particularly in the near term for the coastal regions, where the demand of electricity increases sharply and fuel transport from other regions is already tense. Chinese nuclear circle is interested in MHTGR due to the following reasons. 1. Small capacity of MHTGR is suitable for small power grid in certain areas. 2. Chinese manufacturers are able to provide whole package of conventional island of MHTGR nuclear power plant. 3. Multipurpose MHTGR is attractive for Chinese heavy industries. 4. MHTGR nuclear power plant can be built in suburbs due to inherent safety features. Regarding the users' requirements in China, it can be summarised as: 1. Mature technologies and easy to get license from nuclear safety authority. 2. Emergency zone as small as possible, even unnecessary. 3. 200-300 MWe size desirable. 4. Big portion of domestic share in engineering and component supply. 5. Slightly higher electricity price than coal fired. 6. Investment and favourable financing conditions from overseas. 7. Reimbursement of hard currency by countertrade. At present, four working groups, including users, manufacturers and nuclear industry circle, have been established for performing independent feasibility study on building MHTGR demonstration nuclear power plant in China. (author)

5091 (IWGGCR–19, pp. 113-119) **Twenty-nine years of French experience in operating gas-cooled reactors.** Bastien, D. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989. (CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). In *Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.* Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

French experience in the operation of gas-cooled reactors began in 1959 with startup of the G2 reactor in Marcoule. By 1972, seven other plants had entered service, and 145 reactor-years of operation have now been recorded. With the exception of two pairs of duplicated reactors (G3 and G2, SLA2 and SLA1), all these reactors were prototypes. They broadened French experience and enabled us to determine the advantages and drawbacks of the various technologies employed. Based on this experience, we now know the limitations of natural-uranium reactors moderated with graphite and cooled with CO_2, and we can apply the lessons to other types of gas-cooled reactors. For this purpose, this paper discusses problems and accidents which occurred over the last 29 years. 8 figs.

5092 (IWGGCR–19, pp. 120-132) **Operating experience with the Latina Magnox reactor.** Volterra, E. (Ente Nazionale per l'Energia Elettrica, Latina (Italy)). International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989. (CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). In *Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.* Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

The paper describes the plant and gives the relevant data concerning its operational life. Construction of the Station started in 1958, first criticality occurred in Dec 1962, first connection to the grid in May 1963, and commercial operation started from Jan 1964. Periodic inspections of components in the primary circuit were thus scheduled to check for the integrity and present damages. Repairs were carried out to assure safe operation. In Nov 1986 the Station was shut-down for planned overhaul and after the national referendum (Nov 87) called in by the post-Chernobyl mass criticism towards nuclear generation, the Italian Government decreed its final shutdown (Dec 1987) and the owner was ordered to start actions to bring the plant in a passive protective condition (equivalent to IAEA Phase 2 of decommissioning). The governmental decision is political and not based on safety grounds. The operating licence, renewed in 1985 by the Italian Ministry of Industry, was due to expire in 1992, with provisions of possible extension. Renewal in 1985 was obtained after a full safety review made with the same ground-rules of CEGB Magnox Stations. It was, in its completeness, an anticipation of CEGB's Long Term Safety Review for 20 years operation. Only very limited backfitting was considered necessary; in particular a new emergency feed water system was built and modifications or safety circuits were under completion. Also a first-level Probabilistic Safety Assessment was carried out, and areas where simple plant modifications could give significant improvement in overall safety were found. The cumulative electrical output has been 26 TWh, scoring an average availability factor of 73%. A description of the inspections to the primary circuit internals and repairs is detailed. Other unusual operating events and radiation protection data are also outlined.

5093 (IWGGCR–19, pp. 143-152) **Safety criteria for advanced HTGR concepts.** Kroeger, W. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Sicherheitsforschung). International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989. (CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). In *Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.* Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

It is commonly agreed that advanced HTGR concepts must be licensable, which means that they must fulfil existing regulatory requirements. Furthermore, it is necessary to improve their public acceptance and they must even be suitable for urban sites. Therefore, they should be 'safer' than existing plants, which mainly means with respect to low-frequency or beyond-design severe accidents. Last but not least, the realization of advanced HTGR would be easier if commonly shared safety principles could be stated ensuring this further increased level of safety internationally. These qualitative statements need to be cast into quantitative guidelines which can be used as a rationale for safety evaluation. This paper tries to describe the status reached and to stimulate international activities. (author). 12 refs, 4 figs, 3 tabs.

5094 (IWGGCR–19, pp. 152-156) **Design and safety aspects of nuclear district heating reactors.** Brogli, R. (Paul Scherrer Inst. (PSI), Wuerenlingen (Switzerland)); Mathews, D.; Pelloni, S. International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989. (CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). In *Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.* Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Extensive studies on the rationale, the potential and the technology of nuclear district heating have been performed in Switzerland. Beside economics the safety aspects were of primary importance. Due to the high costs to transport heat the heating reactor tend to be small and therefore, minimally staffed and located close to population centers. Stringed safety rules are therefore applying. Gas cooled reactors are well suited as district heating reactors since they have due to their characteristics several inherent features, significant safety margins and a remarkable radioactivity retention potential. Some ways to mitigate the effects of water ingress and graphite corrosion are under investigation. (author). 5 refs, 3 figs.

5095 (IWGGCR–19, pp. 156-163) **Licensing experience of the modular high-temperature gas-cooled reactor (MHTGR).** Silady, F.A. (General Atomics, San Diego, CA (USA)); Cunliffe, J.C.; Walker, L.P. International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989. (CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). In *Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.* Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

The MHTGR is an advanced reactor concept being developed under a cooperative program involving the U.S. Government, the nuclear industry, and the utilities. The design utilizes the basic HTGR features of ceramic fuel, helium coolant, and a graphite moderator. However, the specific size and configuration are selected to utilize the inherent characteristics of these materials to develop passive safety features that provide a significantly higher margin of safety than current generation reactors. The design meets the U.S. Environmental Protection Agency's Protective Action Guidelines at the site boundary, hence precluding the need for sheltering or evacuation of the public during any licensing basis event. This safe behavior is not dependent upon operator action and is insensitive to operator error. The MHTGR Licensing Plan agreed to with the U.S. Nuclear Regulatory Commission (NRC) is discussed with particular attention to the framework of the preapplication review. The objective and scope of each key document prepared for the NRC review is presented. A summary is provided of the safety response to events challenging the functions relied on to retain radionuclides within the coated fuel particles. The regulatory interaction process and results are discussed through the NRC staff, NRC contractor, and ACRS reviews. (author). 11 refs, 3 figs.

5096 (IWGGCR–19, pp. 163-175) **Storage and final dispcsal of spent HTR fuel in the Federal Republic of Germany.** Kirch, N. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.)); Brinkmann, H.U. International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989. (CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). In *Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.* Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

Current HTGR designs in the Federal Republic of Germany are based on low-enriched uranium fuel. The paper describes various aspects of this fuel cycle including spent fuel treatment and technical concepts for intermediate storage and final disposal. In addition the status of related research and development programmes is presented. (author). 11 figs, 3 tabs.

5097 (IWGGCR–19, pp. 104-112) **Design considerations and improvements of the high temperature engineering test reactor (HTTR) for a reactor outlet coolant temperature of 950 deg. C.** Sudo, Y. (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan)); Saito, S.; Yamada, M.; Uno, M.; Ohno, T. International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989. (CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). In *Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.* Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

In 1969, JAERI started the development of a very high temperature gas-cooled reactor (VHTR) which could produce outlet gas of nearly 1000 deg. C for the broad utilization of direct nuclear energy, not only for electric power generation but also for nuclear heat and has been carrying out various research and development for the project along with the Japanese industries. In 1987, the Japanese Atomic Energy Commission issued the recommendation on the early construction of HTTR which can produce an outlet gas temperature of 850 deg. C first and 950 deg. C finally, so that the necessary research and development may be carried out for establishing and updating the technology basis for advanced HTGRs in future and various innovative basic research may be conducted as an irradiation test reactor at very high temperature of around 1100 deg. C. This paper presents the design considerations and improvements for achievement of 950 deg. C outlet gas temperature in HTTR along with the design outline of HTTR. The HTTR consists of a 30 MWt core, a primary cooling loop with a helium-helium intermediate heat exchanger and a helium-pressurized water cooler, an auxiliary cooling loop and two reactor vessel cooling systems. The core is composed of 30 fuel columns, 16 control rod columns and 12 replaceable reflector columns, each made by graphite blocks and is cooled by helium gas of 395 deg. C at the inlet of reactor vessel, which flows downward through the core. The maximum fuel temperature with 950 deg. C outlet gas temperature is designed to be about 1500 deg. C in the normal operation and lower than 1600

deg. C during the anticipated abnormal transients. Major design considerations are forwarded to proper blockwise distribution of fuel enrichment, proper flow distribution in the reactor vessel, fuel block design, elimination of hot flow streaks and the design of associated major components in the primary cooling loop.

5098 (IWGGCR–19, pp. 132-140) **ISIS operation: Robotics repair work on the CHINON A3 natural uranium, carbon dioxide cooled, graphite moderated reactor.** Hilmoine, R.M.E. (Electricite de France, Avoine (France)). International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989. (CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). In *Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.* Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

After describing the upper internal support structures of the CHINON A3 reactor, problems resulting from degradation due to corrosion and to difficulties of the ISIS operation are presented here. The repair method is as follows: all tools and repair parts reach the working area by feeding-pipes drilled through the 7 m thick concrete vessel surrounding the reactor core; the robots handle into the reactor, the tool heads and the repair parts which are automatically positioned and welded around the corroded structure, thus restoring the support of measurement devices. The parts are either linked together or to the existing structure by means of 2 studs of 12 mm in diameter. The different phases to sort out a problem are: in-core topography, reconforming of the full-scale mock-up with the repair area, learning on this mock-up and in-core repair. The robots used have an 11 meter long, 0.22 meter across telescopic mast with jointed arms reaching a radius of 2.7 m. Then the useful load is 70 daN and the repeatability 0.1 mm. Different tool heads can be handled by the robot: telemeter and laser reconstruction: it allows to locate the in core points and to materialize them on the mock-up by a laser crossed-beams locating technique; scouring: it cleans the corroded parts of the structures before welding; welding: it allows the parts handling and the carried studs welding; screwing; tensile test: carried out when the stud welds are defective. A high level computerized control system is organized around a central unit which calculates the displacements of robots and synchronises the actions of different tools by communicating with several local units. A 100,000 hour designing, a 200,000 hour building and assembling and a 450,000 hour operating on working area were necessary to repair 15 out of the 102 corroded structures by fitting and welding 205 repair parts. 10 figs.

5099 (WSRC-tr–137) **Outline of research program on thorium fuel supported by grant-in-aid for energy research from Ministry of Education.** Shibata, Toshikazu (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). 25p. Translated from Nippon Genshiryoku Gakkaishi (Japan). *Nippon Genshiryoku Gakkaishi (Japan),* 26(8): 679-685 (Aug 1984). Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035.

Since 1980, the Research Program on Thorium Fuel has been performed under the support of Grant-in-Aid for Energy Research of the Ministry of Education, Science and Culture of Japanese Government on the university basis including several tens professors. This report describes the outline and review of the symposium held on January 31, 1984. It consists of nuclear data, reactor physics, thorium fuel, irradiation of thorium, down-stream, biological effect, molten salt reactor engineering and others. It has been the first trial to perform such a big systematic cooperative studies in nuclear field on the university basis in Japan. 23 refs., 5 figs., 1 tab.

2104 Power Reactors, Nonbreeding, Otherwise Moderated or Unmoderated

Refer also to citation(s) 5160, 6201

5100 (BARC–1443) **INDHAN: an auto fuel program for PHWRS.** Dhanvij, R.F. (Nuclear Power Corporation, Bombay (India)); Purandare, H.D. Bhabha Atomic Research Centre, Bombay (India). 1989. 17p. Order Number DE90608883. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The objective of operating a pressurised heavy water reactor at the designed power level can be achieved only by a successful refuelling strategy. This requires careful analysis of the data of simulation of reactor operation and operating station data as well. The fuel scheduling is then carried out following some guidelines. This report describes a computer code INDHAN written for the purpose of selecting fuel channels for refuelling in PHWR based upon an analysis of theoretical and operational data. (author). 6 refs., 2 tabs., 3 figs.

5101 (IAEA-TECDOC–510) **Status of advanced technology and design for water cooled reactors: Heavy water reactors.** International Atomic Energy Agency, Vienna (Austria). Jul 1989. 201p. Order Number DE90610197. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

In 1987 the IAEA established the International Working Group on Advanced Technologies for Water-Cooled Reactors (IWGATWR). Within the framework of the IWGATWR the IAEA Technical Report on Status of Advanced Technology and Design for Water Cooled Reactors, Part I: Light Water Reactors and Part II: Heavy Water Reactors, has been undertaken to document the major current activities and trends of technological improvement and development for future water reactors. Part I of the report dealing with Light Water Reactors (LWRs) was published in 1988 (IAEA-TECDOC-479). Part II of the report covers Heavy Water Reactors (HWRs) and has now been prepared. This report is based largely upon submissions from Member States. It has been supplemented by material from the presentations at the IAEA Technical Committee and Workshop on Progress in Heavy Water Reactor Design and Technology held in Montreal, Canada, December 6-9, 1988. It is hoped that this part of the report, containing the status of advanced heavy water reactor technology up to 1988 and ongoing development programmes will aid in disseminating information to Member States and in stimulating international cooperation. Refs, figs and tabs.

5102 (IWGFPT–32, pp. 38-50) **Fuel rod performance code for advanced thermal reactor.** Kamimura, K. (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)); Abe, T.; Mishima, T. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

The Advanced Thermal Reactor (ATR) is a heavy-water moderated, boiling-light-water cooled, pressure tube type reactor, developed in Japan and has the remarkable feature in beneficial usability of plutonium-uranium mixed oxide fuel (MOX). FUGEN, ATR Prototype Reactor (165 MWe) has been successfully operated since March 1979 and the ATR Demonstration Plant (606 MWe) is being designed. At present, the decrease of fuel cycle cost is one of the most important subjects. The fuel rod performance code, "CEDAR-ATR", has been developed to be used for high burnup fuels. "CEDAR" Code is a fuel pin performance code for Fast Breeder Reactor developed by Power Reactor and Nuclear Fuel Development Corporation (PNC). "CEDAR-ATR" is modified from "CEDAR" to be applied to ATR and LWR fuel rods. The main performance models considered in the code are as follows: Gap Conductance Model; Fission Gas Release Model; Relocation Model; Fuel Densification Model; Swelling Model; Hot Pressing Model; Restructuring Model (Void Migration Model) etc. We verified the "CEDAR-ATR" code by using the PNC fuel rods irradiation data in "FUGEN", "SGHWR", "HALDEN" and so on. Fuel center temperature and fission gas release rate are calculated by the code and compared with the experimental data. The results are acceptable for us to use "CEDAR-ATR" as an evaluation code for ATR fuel. (author). 11 refs, 12 figs, 4 tabs.

5103 (ORNL/FTR–3435) **[Man-machine interface of computer controlled reactors]: Foreign trip report, October 16, 1989–October 22, 1989.** Knee, H.E. Oak Ridge National Lab., TN (USA). 10 Nov 1989. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002962. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The traveler and Mr. J.D. White, also of ORNL, met with management and research personnel at the Halden Reactor Project (HRP) in Halden, Norway to assess the potential for future collaborative research between ORNL and the HRP in the areas of advanced controls and man-machine interface. The travelers were provided with two-and-a-half days of briefings and demonstrations that addressed a number of computer-oriented support systems (COSSs) and an integrated surveillance and control system (ISACS). The purpose of the ISACs is to integrate the various COSSs into a "super" support environment for the human operator of a nuclear power plant. The HRP has not only developed a number of COSSs over the past decade, it has also built an experimental environment in which to evaluate the emerging support systems, and to examine the impact on human performance. Most of their research has focused on nuclear-oriented informational displays for the operator, with little to no emphasis on control. The Halden experimental environment and expertise in displays, coupled with ORNL's recognized expertise in the area of advanced controls, could provide strong control system/room design support for DOE's Advanced Reactor Designs, especially the Advanced Liquid Metal Concept.

2105 Power Reactors, Breeding

Refer also to citation(s) 5103, 5181, 5183, 5209, 5656

5104 (ETDE-IT–89-18) **Corrosion behaviour of the tool steel of the fuel charging machine during cleaning process (PEC Brasimone Reactor, Italy).** Caponetti, R.; Cataldi, D.; Cunsolo, A.; Falzetti, L.; Petrazzuolo, F.; Innarella, C.; Cigna, R.; Gusmano, G. ENEA, Casaccia (Italy). Centro Ricerche Energia. 1988. 11p. (CONF-881009–7: 4. international conference on liquid metal engineering and technology, Avignon (France), 17-21 Oct 1988). Order Number DE90724593. Available from NTIS (US Sales Only), PC A03/MF A01.

Paper presented at the LIMET 88 4th International conference on liquid metal engineering and technology. Avignone, France. October 17-21 1988.

The sodium removal process for the PEC reactor has been usually carried out by means of butylcellosolve. Recently, in order to eliminate flammable organic solvent from the reactor building, it was decided to evaluate the possibility of using an atomized water method for the cleaning of the fuel charge machine. Two important problems were immediately identified: lower removal process efficiency (since the geometries of the fuel charge machine are complex, there are a number of areas of retention where liquid access is difficult); component damage due to corrosion processes (the main risk is associated with the formation of aqueous NaOH which can give rise to caustic stress corrosion cracking. It should be noted that the tool steel 18/4/1, material of the self-centring gripper, has little compatibility with caustic solutions). A test programme was designed whose main aims were: cleaning efficiency determination, using nitrogen gas or, alternatively, carbon dioxide, of gripper prototype by atomized water method; study of the corrosion behaviour of tool steel in caustic solutions. This paper reports the results of the corrosion tests.

5105 (UKAEA-CS-R–001(R)) **Review of the UK fast reactor programme.** Wheeler, R.C.; Bramman, J.I. (eds.). UKAEA Fast Reactor Development Directorate, Risley (UK). Apr 1988. 43p. Order Number DE90610200. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The fast reactor programme in the United Kindom is reviewed under the following headings: Progress with PFR; Reprocessing: Commercial Design Studies; Structural Integrity; Engineering and Components; Materials; Sodium Chemistry; Core and Fuel; Safety; Plant Performance. (author).

2107 Regulation and Licensing

Refer also to citation(s) 4890, 4891, 5196, 5197, 5198, 5199, 5201, 5202, 5205

5106 (NUREG–0386-Digest-5-Rev.2) **United States Nuclear Regulatory Commission Staff practice and procedure digest: Commission, Appeal Board and Licensing Board Decisions, July 1972–December 1988: Revision 2.** Nuclear Regulatory Commission, Washington, DC (USA). Office of the General Counsel. Oct 1989. 658p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A99/MF A01 - GPO; OSTI; INIS.

This Revision 2 of the fifth edition of the NRC Staff Practice and Procedure Digest contains a digest of a number of Commission, Atomic Safety and Licensing Appeal Board, and Atomic Safety and Licensing Board decisions issued during the period from July 1, 1972 to December 31, 1988, interpreting the NRC's Rules of Practice in 10 CFR Part 2. This Revision 2 replaces in part earlier editions and revisions and includes appropriate changes reflecting the amendments to the Rules of Practice Effective through December 31, 1988. The Practice and Procedure Digest was originally prepared by attorneys in the NRC's Office of the Executive Legal Director (now, Office of the General Counsel) as an internal research tool. Because of its proven usefulness to those attorneys, it was decided that it might also prove useful to members of the public. Accordingly, the decision was made to publish the Digest and subsequent editions thereof. This edition of the Digest was prepared by attorneys from Aspen Systems Corporation pursuant to Contract number 18-89-346.

2108 Economics

Refer also to citation(s) 4989, 5083, 5096, 5260, 5491, 5492

5107 (IAEA-TECDOC–513, pp. 73-91) **Management of spent fuel and post-irradiation examination fuel samples from experimental, research and prototype power reactors in the United Kingdom.** Fellingham, L.R. (UKAEA Harwell Lab. (UK)). International Atomic Energy Agency, Vienna (Austria). Sep 1989. (CONF-8811290–: Technical committee on the safe management of spent fuel from research reactors, prototype power reactors and fuel from commercial power reactors that has been subjected to post-irradiation examinatio, Vienna (Austria), 28 Nov - 1 dec 198 In *Management of spent fuel from research and prototype power reactors and residues from post-irradiation examination of fuel. Proceedings of a technical committee meeting held in Vienna, 28 November - 1 December 1988.* Order Number DE90610069. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

There are a number of experimental, research and prototype power reactors in the United Kingdom, situated in nuclear power research establishments, universities and industrial companies. They include materials testing reactors, Argonaut and Triga type research reactors and prototypes of advanced gas-cooled, high temperature, heavy water moderated steam generating and fast reactors. These reactors use a wide variety of types of fuel which differ in the chemical and metallurgical nature of the fissile material, enrichment, cladding material, geometrical form of the fuel elements etc. Various schemes are used for the management of the spent fuel from these reactors. Some of these schemes make use of the extensive reprocessing and fuel fabrication facilities in the UK. These include reprocessing plants at Dounreay for MTR and prototype fast reactor fuel, a commercial reprocessing plant at Sellafield for spent uranium metal fuel from gas-cooled Magnox reactors and another plant (THORP), which will be available in the early 1990's to reprocess oxide fuel from thermal reactors. In this paper details are given on the management of the spent fuel from these various reactors and also on samples of the spent fuel from the prototype power reactors which have been subjected to post irradiation examination. (author). 8 refs, 3 tabs.

5108 (IAEA-TECDOC–518) **Energy and nuclear power planning study for Thailand. Report prepared by a team of experts from several agencies and organizations of Thailand with guidance of the IAEA.** International Atomic Energy Agency, Vienna (Austria). Aug 1989. 407p. Order Number DE90610351. Available from NTIS (US Sales Only), PC A18/MF A01 - OSTI; INIS.

The present report describes the study conducted in co-operation with several agencies and organizations from Thailand and covers the energy and electricity requirements and the optimal expansion plans for the power generating system for this country up to year 2011. It is emphasized that the study was carried out by a team of experts from the Electricity Generating Authority of Thailand (EGAT), the National Economic and Social Development Board (NESDB), the National Energy Administration (NEA) and the Office of Atomic Energy for Peace (OAEP), who were fully responsible for all phases of the study, including the production of the present report. The IAEA's responsibility was to provide overall co-ordination and general guidance during the conduct of the study, as well as training and assistance in the implementation and use of the IAEA's computerized planning methodologies on the computer facilities of Thailand. Refs, figs and tabs.

5109 (IFE/KR/E–89/003) **Nuclear power - status and development 1988/1989.** Lingjaerde, R. Institutt for Energiteknikk, Kjeller (Norway). Aug 1989. 43p. (In Norwegian). Order Number DE90610352. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A review of the present global position of nuclear power is given. The role to play for nuclear energy in strategies for environmentally sustainable development is also dealt with.

5110 (INIS-BR–1742) **Future options for electric power production with fossil and renewable energy sources.** Hassman, K. (Siemens A.G., Erlangen (Germany, F.R.)). American Nuclear Society, Rio de Janeiro, RJ (Brazil). Latin American Section. 1989. 25p. (CONF-890699–: Symposium on importance of nuclear power for power supply after 1990: benefits and difficulties, Rio de Janeiro (Brazil), 11-15 Jun 1989). Order Number DE90610353. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A comparative study about nuclear energy, solar energy and wind energy in Germany is presented.

5111 (IWGGCR–19, pp. 43-51) **Economic evaluation of HTRs as applied to an oil industry.** Djokolelono, M. (National Atomic Energy Agency, Jakarta (Indonesia)); Soedibjo, R.; Padmosoebroto, S. International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989. (CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). In *Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.* Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

General design requirement pertinent to the applied oil field is presented. Economic calculation of HTRs application in the enhanced oil recovery was performed. It includes the consideration of the current structure as practised so far in the oil industry in Indonesia. Sensitivity studies were done to enlighten the influence of uncertainties related to the HTRs, i.e. capital costs, oil prices, depreciations, investment credits, domestic obligation, financing terms. (author). 3 refs, 4 figs.

22 NUCLEAR REACTOR TECHNOLOGY

2201 Theory and Calculation

Refer also to citation(s) 5038, 5152, 5153, 5154, 5156, 5157, 5210

5112 (AEEW-R–2411) **Improvements to the subgroup option and the QA of MONK5W.** Grimshaw, D.; Davies, N.; Hutton, L. UKAEA Atomic Energy Establishment, Winfrith (UK). Reactor Physics Div. Oct 1988. 32p. Order Number DE90608643. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This report covers the changes that have been made to MONK5W since release 5A. These include an improved SUBGROUP treatment which removes the approximations inherent in previous versions of the code and which reduces the storage requirements which had previously made some calculations impossible to perform. A minor error has also been corrected which occurred when using P0 scattering with NOVICE data. Furthermore 13 minor code changes have been made which are mainly additional user error traps, or user hidden changes to improve the code probability. However 3 were minor bug corrections: an incorrect output format; an incorrect calculation of the standard deviation on the flux and an overwriting problem for large storage burnup calculations. Finally, one of the largest and most varied verification and validation exercises ever to be performed with MONK5W has been done. This exercise used the MONK5W QA database which has been previously reported. It contains a hundred test cases which have been specially designed to provide a testbed and some method of determining the range of the validity of the MONK5W package. The code has been improved so that it can be applied more successfully to a wider range of problems. Together with the vigorous testing of the code, MONK5W is now in a better shape than it has ever been. The improvements are important because users can use the code in circumstances where previously it could not be used. The stringent testing is important because users now demand a better quality assessed package than was once acceptable. (author).

5113 (CTA-IEAv-RP–011/85) **Cross sections of the lumped fission products for the AMZ library.** Ono, S.; Corcueca, R.P.; Nascimento, J.A. Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. 17 May 1985. 37p. (In Portuguese). Order Number DE90610110. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The preparation of the lumped fission product cross section for the AMZ library is described. For this purpose 100 nuclides were selected. The cross sections for each nuclide were generated by the NJOY code with evaluated nuclear data from ENDF/B-V, complemented with ENDF/B-IV data. A comparison is performed between the data obtained and the lumped fission product cross section of JFS-II.

5114 (CTA-IEAv-RP–029/89) **Estimate of maximum excursion power due to reactivity insersion in system using a reactor nodal model.** Rosa, M.A.P.; Rocamora Junior, F.D.; Podowski, M.Z. Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. Aug 1989. 25p. (In Portuguese). Order Number DE90608646. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The objective of this work is to show possibility of extension to models of a method to estimate peak power in a reactor subjected to a certain reactivity excursion, originally developed for the point kinetic model. For this purpose, it is required the definition of additional conditions which in general are dependent upon the problem. This extension allows one to obtain information not only about the peak power but also about its distribution in the core.

5115 (FEI–1910) **Solution of the quasistationary problem of neutron transport in the MCDEN and MCDENSP programs.** Tarasova, O.B.; Polevoj, V.B. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst. 1988. 20p. (In Russian). Order Number DE90610111. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The technique realizing earlier developed approach to solution of the problem for eigenvalue of neutron flux asymptotic decrement α_0 in a reactor using the Monte Carlo method is considered. The approach is based on evaluation of the dependence of prompt neutron lifetime $Z_p(\alpha)$ on α parameter when simulating neutron transport in conditionally critical reactor. The dependence $Z_p^{-1}(\alpha)$ is approximated by Taylor series near $\alpha = 0$, as well as by the polynomial passing through calculated $Z_p^{-1}(\alpha_i)$ values in α_i point set. Neutron trajectory splitting with neutron age increase is used to decrease the dispersion. The unknown α_0 value is determined from the equation relating the asymptotic decrement of prompt neutron flux, their lifetime and reactivity. Quasistationary distributions over reactor zones for 26-group fluxes, fission neutron sources and other reactions are calculated at fixed α_0 value obtained by preliminary calculation. The difference between functionals for quasistationary and conditionally critical fluxes is illustrated by model calculations.

Examples where Z_p calculated for conditionally critical flux is low by more than one order are presented. 10 refs.; 5 figs.

5116 (INDC(INS)–001) **Plans for use of ENDF/B in reactor research in Indonesia: Paper presented in the second Asian Symposium on Research Reactors (ASRR-II) held at Serpong, Indonesia 23-25 May 1989.** Santoso, B. (National Atomic Energy Agency, Jakarta (Indonesia)); Syaukat, A.; Subki, I.; Ganesan, S. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jul 1989. 22p. (CONF-8905246–: 2. Asian symposium on research reactors (ASRR-II), Serpong (Indonesia), 23-25 May 1989). Order Number DE90610959. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Nuclear data are numerical constants of nature which quantify the nuclear behaviour of all elements and isotopes which make up the reactor medium and its environment, and which are needed as input for performing design calculations for safe and reliable operation of nuclear reactors. The nuclear data are available in the form of recommended values in specially formatted computerized files such as the Evaluated Nuclear Data File-B, known as ENDF/B. The development of base technology in the scheme of original reactor design calculations involves the mastering of the art of ENDF/B data processing. This paper briefly discusses the current status of this activity in Jakarta and gives an account of the future plans, with emphasis on the role of ENDF/B in reactor calculations. (author). 15 refs, 9 figs.

5117 (INIS-BR–1705) **User manual of Quabox/Cubbox computer code.** Pina, C. Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil). Dept. de Reatores. 1981. 86p. (In Portuguese). Order Number DE90608648. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

The Quabox/Cubbox code solves the neutron diffusion equation in function of space and time, in two and three dimensions. The expansion method of neutron flux is based in the spatial flux of second, third and sixth ordem of local polynoms. Results with high acuraccy of flux spatial distribution are obtained even when a great smash is used. The integration of the equation is done using a steady technique of ADE-ADI matrix decomposition. This methods allow a efficient tridimensional evaluation of power.

5118 (INIS-BR–1716) **Study of reactor analysis codes available at IPEN and their application to problems involving the diffusion theory.** Mendonca, A.G. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). 1980. 147p. (In Portuguese). Order Number DE90608651. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

Two computer codes that are available at IPEN for analyses of static neutron diffusion problems are studied and applied. The CITATION code is animed at analyses of criticality, fuel burnup, flux and power distributions etc, in one, two, and three spatial dimensions in multigroup. The EXTERMINATOR code can be used for the same purposes as for CITATION with a limitation to one or two spatial dimensions. Basic theories and numerical techniques used in the codes are studied and summarized. Benchmark problems have been solved using the codes. Comparisons of the results show that both codes can be used with confidence in the analyses of nuclear reactor problems. (author).

5119 (INIS-BR–1746) **Study of reactor analysis code available at Ipen and their application to the time dependent problems.** Yamaguchi, M. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). [1989]. 92p. (In Portuguese). Order Number DE90608652. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Two computer codes available at IPEN are studied and applied to analyze time-dependent problems of nuclear reactors. The GAPOTKIN code can be used to analyze short-term transient behaviours and the CITATION code is applicable to long-term burnup analysis. Basic theories and numerical techniques used in the codes are studied and summarized. Several standard problems are solved. Comparisons of the obtained and published solutions show that both codes can be used with confidence in the analysis of nuclear reactors. (author).

5120 (UJV–8727-R) **Numerical solution to the problem of criticality by Monte Carlo method.** Kyncl, J. Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia). Apr 1989. 6p. Order Number DE90608886. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

A new method of numerical solution of the criticality problem is proposed. The method is based on the results of the Krein and Rutman theory. Monte Carlo method is used and the random process is chosen in such a way that the differences between results obtained and exact ones would be arbitrarily small. The method can be applied for both analogous and nonanalogous random processes. (author). 8 refs.

2202 Components and Accessories

Refer also to citation(s) 4976, 4980, 4996, 4997, 4998, 4999, 5013, 5014, 5016, 5017, 5104, 5156, 5185, 5629

5121 (CEGB-RD/L–3347/R88) **Verification of failure avoidance concepts in R6 Rev3.** Milne, I.; Knee, N. Central Electricity Research Labs., Leatherhead (UK). Sep 1988. 22p. Order Number DE90610118. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The first part of this Report outlines how recent developments in fracture mechanics have led to a more accurate interpretation of the two-criteria approach to defect assessment. The implementation of these developments into Revision 3 of the Central Electricity Generating Board code of practice for the assessment of the defect tolerance of structures (R6) is described. One of the key elements of the revised version is the recommendation that the failure assessment line should be derived from the actual tensile stress/strain properties of the material. The second part of the Report addresses the validation of the method, which is a crucial step on the way to obtaining acceptance of R6 by, in particular, the regulatory bodies. The range of structures used to validate the procedure is illustrated by two examples. The use of conservative data and assumptions is fundamental to the R6 philosophy, which means that the procedure should not be used as a predictive tool. In the second example the importance of making these conservative assumptions is clearly illustrated. (author).

5122 (CEGB-TPRD/L–3290/R88) **Models for ductile crack initiation and tearing resistance under mode 1 loading in pressure vessel steels.** Jones, M.R. Central Electricity Research Labs., Leatherhead (UK). Jun 1988. 32p. Order Number DE90610119. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Micromechanistic models are presented which aim to predict plane strain ductile initiation toughness, tearing resistance and notched bar fracture strains in pressure vessel steels under monotonically increasing tensile (mode 1) loading. The models for initiation toughness and tearing resistance recognize that ductile fracture proceeds by the growth and linkage of voids with the crack-tip. The models are shown to predict the trend of initiation toughness with inclusion spacing/size ratio and can bound the available experimental data. The model for crack growth can reproduce the tearing resistance of a pressure vessel steel up to and just beyond crack growth initiation. The fracture strains of notched bars pulled in tension are shown to correspond to the achievement of a critical volume fraction of voids. This criterion is combined with the true stress - true strain history of a material point ahead of a blunting crack-tip to predict the initiation toughness. An attempt was made to predict the fracture strains of notched tensile bars by adopting a model which predicts the onset of a shear localization phenomenon. Fracture strains of the correct order are computed only if a "secondary" void nucleation event at carbide precipitates is taken into account. (author).

5123 (NUREG/CR–5188) **Fracture toughness characterization of nuclear piping steels.** Hiser, A.L. (Materials Engineering Associates, Inc., Lanham, MD (USA)). Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Materials Engineering Associates, Inc., Lanham, MD (USA). Nov 1989. 193p. Sponsored by Nuclear Regulatory Commission. (MEA–2325). Available from NTIS, PC A10/MF A01 - GPO - OSTI.

To assess the integrity of piping systems in nuclear power plants, materials' property information such as fracture toughness and stress-strain data are required. This report summarizes findings from testing of heats of piping steel representing a cross-section of those included in nuclear plants. Included are ferritic steels, austenitic stainless steels and one heat of an Inconel alloy. Besides the characterization of piping steels, additional studies examined the effect on J-R curves of flattening specimen blanks, and assessed specimen size effects and through-thickness variability on stress-strain curves. 20 refs., 120 figs., 38 tabs.

5124 (ORNL/FTR–3470) **[Heavy-section steel irradiation program]: Foreign trip report, October 21, 1989–November 11, 1989.** Nanstad, R.K. Oak Ridge National Lab., TN (USA). 27 Nov 1989. 50p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. Order Number DE90003522. Available from NTIS, PC A03/MF A01 - OSTI.

The traveler served as a member of the delegation from the US Nuclear Regulatory Commission in an information exchange meeting on nuclear safety with the Czechoslovak Atomic Energy Commission in Prague, Czechoslovakia, October 23–27, 1989. The exchange included meetings at the Institute of Nuclear Research in Rez, visits to the Skoda Concern in Pilsen and the Dukovany Nuclear Power Plant, and meetings at the Czechoslovak Commission for Nuclear Energy in Prague which resulted in the signing of a protocol agreement. From October 30 to November 6 the traveler presented lectures and participated in discussions on radiation effects and fracture mechanics at the Harwell Laboratories, Oxfordshire, United Kingdom; at the institute for Materials, Stuttgart, Federal Republic of Germany; at the Institute of Technology, Trondheim, Norway; and at the Royal Institute of Technology, Stockholm, Sweden. The effects of radiation on nuclear pressure vessel and support steels, and the conduct of experimental fracture mechanics programs to evaluate structural integrity were the primary topics of discussion during those visits. Additionally, the traveler attended workshop meetings of the International Group on Radiation Damage Mechanisms in Pressure Vessel Steels (IG-RDM) in Helsinki, Finland. This workshop of the IG-RDM was the first technical meeting of the IG-RDM following its installation on October 7, 1988. The meetings resulted in detailed exchange of technical progress between participants, identification of specific areas requiring continued research, and procedures for collaboration and sharing of resources.

5125 (UFRJ-COPPE-GAPS–01/83) **Reavaluation of the reliability analysis of the low pressure injection system for Angra-1.** Oliveira, L.F.S. de; Fleming, P.V.; Frutuoso e Melo, P.F.F.; Tayt-Sohn, L.C. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1983. 58p. (In Portuguese). Order Number DE90608658. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

The emergency core cooling system of Angra 1 is analysed aiming at the low pressure injection systems, using the fault tree technique. All the failure mode of the components are considered for this analyse. (author).

5126 (UFRJ-COPPE-GAPS–04/83) **Reliability of accumulators systems for Angra-I: a reavaluation.** Oliveira, L.F.S. de; Fleming, P.V.; Frutuoso e Melo, P.F.F.; Tayt-Sohn, L.C. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1983. 65p. (In Portuguese). Order Number DE90608659. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

A new evaluation of reliability analysis for accumulators systems of Angra-1, based on a study done in 1979/80 is done the methodology used is the same (WASH-1400). An additional point, a computer program was used to obtain the minimum cuts. (author).

5127 (UFRJ-COPPE-GAPS–05/83) **Reliability analysis of cooling system for Angra 1 component.** Oliveira, L.F.S. de; Fleming, P.V.; Frutuoso e Melo, P.F.F.; Tayt-Sohn, L.C.O. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1983. 59p. (In Portuguese). Order Number DE90608660. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

A reliability analysis for the cooling systems of Angra 1 is presented. (author).

5128 (WSRC-RP–89-679) **Design and testing of a thermal liquid level sensor: Final report.** Levin, A.E.; Schneider, A.; Harris, J.D.; Pfeifer, H.; Croft, W.D. Westinghouse Savannah River Co., Aiken, SC (USA); Georgia Inst. of Tech., Atlanta, GA (USA). 1989. 24p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. (CONF-890890–2: 9. international heat transfer conference, Jerusalem (Israel), 19-24 Aug 1989). Order Number DE90003501. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Liquid level detection is of extreme importance in nuclear reactor systems. In the event of a loss of coolant, plant operators should be able to ascertain quickly whether there is danger of the core becoming uncovered. 3 refs., 8 figs., 1 tab.

2203 Fuel Elements

Refer also to citation(s) 5166

5129 (IWGFPT–32) **Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.** International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. 322p. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

The present meeting was scheduled by the International Atomic Energy Agency, upon proposal of the Members of the International Working Group on Water Reactor Fuel Performance and Technology (IWGFPT). This meeting was the fifth in the series of IAEA meetings on the topic of Water Reactor Fuel Element Modelling, previous meetings being held in 1978, 1980, 1982 and 1984. Sixty-seven participants from 21 countries attended the meeting, and 35 papers were presented and discussed. These numbers are almost exactly the same as for the 1984 meeting, which demonstrates a continuing interest in the topic. The papers were presented in five sessions under the following headings: Session I - General Modelling (6 papers); Session II - Thermo-Mechanical Modelling and PCI (7 papers); Session III - Fission Gas Release (7 papers); Session IV - Transient Behaviour (8 papers); Session V - Axial Gas Transport and Thermal Modelling (7 papers). A separate abstract was prepared for each of these 35 papers. Refs, figs and tabs.

5130 (IWGFPT–32, pp. 27-28) **Future directions in transient fuel performance modelling.** Peddicord, K.L. (Texas A and M Univ., College Station, TX (USA). Dept. of Nuclear Engineering); Montgomery, R.O.; Bechler, E.W.; Simmons, J.W. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

In this paper, trends in transient fuel modelling practices are discussed. It is anticipated that the approach will continue towards physically derived models which are coupled with in-depth irradiation experience. Because users and vendors will be focusing increasingly on fuel element reliability, the impact of transient events, which can be expected to play an important role in fuel failures, must be better represented. New fuel element designs will also impose additional requirements on computational models. However, the evolution of industry expectations for fuel performance may provide an opportunity for modellers to make greater contributions in guiding the development of fuel technology. (author).

5131 (IWGFPT–32, pp. 28-38) **Description of the ENIGMA fuel performance code.** Jackson, P.A. (British Nuclear Fuels plc, Salwick, Preston (UK). Springfields Works); Turnbull, J.A.; White, R.J. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and

Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

An overview of the main features and characteristics of the ENIGMA code developed by BNFL and CEGB is given. A general description as well as some specific sub-models are presented. One of the characteristics of this code is its fully-modular conception. Each submodel treats a well identified basic mechanism. This detailed, semi-empirical formulation of physical models contributes to reducing the number of tuning parameters. The advantage of such a modular construction is the easy replacement of a model if a less empirical one becomes available, or if shortcomings in current models are discovered. The code can be run on a PC equipped with a transputer. An extensive programme of code assessment is currently underway. (author). 9 refs, 9 figs, 1 tab.

5132 (IWGFPT–32, pp. 73-77) **Mechanical deformation models based on segment mechanics.** Merckx, K.R. (Advanced Nuclear Fuel Corp., Richland, WA (USA)). International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

An approach for modeling the mechanical response of oxide fuel pellets is presented which accounts for the cracking of the pellets. The pellets are assumed to crack into segments. A circumferential crack displacement distribution and a radial segment displacement are introduced to maintain displacement compatibility. The non-elastic deformation mechanisms (thermal expansion, swelling, densification, fuel creep, and hot pressing) are considered in evaluating the relocation and circumferential crack displacement distribution. The radially dependent circumferential crack displacement distribution is used to adjust the flexibility coefficients for the cracked pellets and to evaluate a radial distribution of the circumferential stress acting on the segment interfaces. The radial stress distribution is evaluated with the equilibrium relations. Assumptions regarding plane strain are used to determine the axial stress distribution. These stress distributions are then used in the fuel creep, swelling and hot pressing models. These "Segment Mechanics" concepts have been formulated into a consistent approach and has been applied in ANF's fuel performance evaluation code RODEX3. Validation studies have been run with this code comparing code predictions with measured responses from the international ramp test programs. The adjustments made to improve the correlation of the RODEX3 adaptation of "Segment Mechanics" with the measured responses are presented. (author). 9 refs, 3 figs.

5133 (IWGFPT–32, pp. 78-90) **Self-adaptive boundary element approach for thermal model of cylindrical fuel.** Sarler, B. (Jozef Stefan Inst., Ljubljana (Yugoslavia). Reactor Engineering Div.); Alujevic, A.; Kuhn, G. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

Calculation procedure based on Boundary Element Method for solving nonlinear radial diffusion problems with h-adaptive discretization capability to reach automatically predetermined accuracy is discussed. Characteristics of the algorithm in case of binary-tree split of the initial domain in connection with harmonic and hyperharmonic space and linear time spline subdomain field approximation are traced. Treatment of nonlinearities occurring from field dependent material properties and nonlinear, also Stefan type boundary conditions is presented. The criteria for refinement and derefinement of mesh and timestep are developed. Verification of the formulation is overviewed. The method is used as a part of the thermal model of cylindrical fuel rod. (author). 43 refs, 9 figs.

5134 (IWGFPT–32, pp. 135-139) **Analysis of fuel rod performance using best estimate and evaluation models of FRAPCON-2 code.** El-Adham, K.A. (Nuclear Regulatory and Safety Centre, Cairo (Egypt)); Berna, G.; Siefken, L. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

FRAPCON-2 Code comprises two calculational models; the Best Estimate (BE) and the Evaluation Models (EM). The latter is considered by the NRC as a conservative model. Both of the models were used to analyze the performance of one of the Gap Conductance (GC2-2) test carried out at the INEL (Idaho). It has been shown that the EM is not conservative in all the cases. The calculational costs of the EM were compared to those of the BE and found to be 1.15 higher. (author). 5 refs, 4 figs, 4 tabs.

5135 (IWGFPT–32, pp. 174-181) **Diffusion coefficient for fission gas atoms in uranium dioxide.** Turnbull, J.A. (Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.); White, R.J.; Wise, C. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

A re-appraisal of the diffusion coefficient for xenon and krypton atoms in uranium dioxide is made based on recent data published in the open literature. In particular the application to high burn-up fuel is considered. A re-evaluation is made of experiments carried out at AERE Harwell and reported by Turnbull, Friskney, Findley, Johnson and Walter, (J. Nucl. Mat. vol. 107, nos 2 and 3, June 1982), and the impact of this on the application of a revised diffusion coefficient is discussed. In particular with a mechanistic approach the release of fission gases can only be correlated with the product $(S/V) * \sqrt{D}$, where S/V is the specific surface area and D is the diffusion coefficient. The paper shows that when applied to both stable and radioactive fission gas release measurements from non-interlinked fuel, the revised values of D give values of S/V in better agreement with calculated geometric values than previously obtained. The paper continues by calculating values of the diffusion coefficient from out-of-pile annealing studies on fuel covering a range of burn-up. The values obtained at high burn-up are compared with values deduced from the elegant EPMA measurements performed on retained xenon in power ramped fuel rods published by Walker and Lassmann, (J. Nucl. Mat. vol. 138, 1986). (author). 14 refs, 9 figs.

5136 (IWGFPT–32, pp. 187-192) **Gas release from oxide SIMFUEL.** Verrall, R.A. (Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.); Palmer, B.J.F.; Hastings, I.J.; Rose, D.H.; Gin, A.Y.H.; Schreiter, D.M.; Matzke, H. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee*

meeting held in Preston, 18-22 September 1988. Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

Thoria and UO_2 SIMFUEL have been fabricated to simulate fuel structures at 40 and 30 MWcenter dotd/kg HE, respectively. While release of implanted Kr is the same during annealing of ThO_2 SIMFUEL and pure ThO_2, significant enhancement of Kr release is observed in preliminary tests on UO_2 SIMFUEL compared with that from UO_2 without additives. In the case of UO_2 SIMFUEL, we speculate that the enhanced release is due to inhibition of intragranular trapping. (author). 27 refs, 5 figs, 2 tabs.

5137 (IWGFPT–32, pp. 195-203) **Towards a mechanistic understanding of transient fission gas release.** Matthews, J.R. (UKAEA Harwell Lab. (UK). Theoretical Physics Div.); Small, G.J. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

Recent experimental results on transient fission gas release from oxide fuels are briefly reviewed. These together with associated microstructural observations are compared with the main models for fission gas behaviour. Single gas atom diffusion, bubble migration, heterogeneous percolation and grain boundary sweeping are examined as possible release mechanisms. The role of gas trapping in bubbles and re-solution by irradiation and thermal processes are included in the comparison. As much of the data, and the main range of interest for light water reactor fuels, is for release during mild transients in fuel with a burn-up below 4%, the role of gas retention on grain boundaries is very important and in some cases dominant. The grain boundaries are found to respond very differently to various gas arrival rates and to local temperature conditions. This can lead to early interlinkage and release in some cases, but retention with accompanying large swelling in others. The role of fission products and the local oxygen content of the fuel are found to be important. The effective fuel stoichiometry is likely to change significantly during transients with substantial effects on the transport processes controlling fission gas behaviour. The results of the evaluation of the models are summarized in mechanism maps for intragranular and grain boundary behaviour. (author). 36 refs, 8 figs.

5138 (IWGFPT–32, pp. 203-208) **Freedom: A transient fission product release model for radioactive and stable species.** MacDonald, L.D. (Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Fuel Engineering Branch); Iglesias, F.C.; Duncan, D.B.; Lewis, B.J. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

A microstructure-dependent fission-gas release and swelling model (FREEDOM) has been developed for UO_2 fuel. The model describes the transient release behaviour for both the radioactive and stable fission-product species. The model can be applied over the full range of operating conditions, as well as for accident conditions that result in high fuel temperatures. The model accounts for lattice diffusion and grain-boundary sweeping of fission products to the grain boundaries, where the fission gases accumulate in grain-face bubbles as a result of vacancy diffusion. Release of fission-gas to the free void of the fuel element occurs through the interlinkage of bubbles and cracks on the grain boundaries. This treatment also accounts for radioactive chain decay and neutron-induced transmutation effects. These phenomena are described by mass balance equations which are numerically solved using a moving-boundary, finite-element method with mesh refinement. The effects of grain-face bubbles on fuel swelling and fuel thermal conductivity are included in its implementation in the ELESIM fuel performance code. FREEDOM has an accuracy of better than 1% when assessed against an analytic solution for diffusional release. The code is being evaluated against a fuel performance database for stable gas release, and against sweep-gas and in-cell fission-product release experiments at Chalk River for active species. (author). 7 refs, 1 fig., 2 tabs.

5139 (IWGFPT–32, pp. 209-220) **Fission gas release and bubble development in UO_2 during high temperature transients.** Small, G.J. (UKAEA Harwell Lab. (UK). Materials Development Div.). International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

Small samples of irradiated UO_2 have been ramped to high temperatures at three ramp rates. The gas release kinetics are in all cases characterised by a spike during the ramp followed by slower release during periods at constant temperature. The ramp release is a function of both heating rate and burn-up. Ceramographic examination suggests that trapping of gas within the grains is minimal during rapid transients and that, at least in lower burn-up ($\leq$ 18 MWd/kgU) fuel, swelling due to grain boundary bubbles is low. This systematic study offers new data for the evaluation and development of transient fission gas release models. (author). 6 refs, 8 figs, 4 tabs.

5140 (IWGFPT–32, pp. 279-285) **Analysis of axial gas flow and mixing in normal and rifled cladding.** Kinoshita, M. (Central Research Inst. of Electric Power Industry, Tokyo (Japan)); Kitajima, S. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

The fission gas release and pellet cladding mechanical interaction are the present main concern of the fuel performance. These phenomena depend heavily on the thermal conductance through gap and also across the pellet. It is known that the released fission gases deteriorate this conductance and cause thermal feedback to increase fuel temperature. Recently the rifled cladding, which has polygonal cross section, was proposed to promote axial gas transport through gap and to reduce fuel temperature especially at power bumping. We have analyzed the effect of local increase of gas pressure, which is due to power increase or power cycling, on the axial gas transport for the cases of normal and rifled cladding. Comparing these cases, we found that less pressure accumulation of the rifled cladding causes much faster gas mixing. (author). 12 refs, 5 figs, 2 tabs.

5141 (IWGFPT–32, pp. 302-306) **Correlation between the potential for thermal feedback and some principal fuel rod state variables.** Kjaer-Pedersen, N. (Studsvik of America, Inc., San Rafael, CA (USA)). International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

Whether or not a self-amplifying thermal feedback mechanism actually comes into play during an overpower event, depends on the balance and timing of several mechanisms and conditions in the fuel rod, all of which may be considered typical of elevated fuel temperature operation. The INTERPIN code simulates and responds to many physical conditions such as fuel fragment relocation, cladding creep-down, bi-axial mechanical constraint, gaseous swelling, fission gas diffusion to grain boundaries, grain boundary saturation, etc., and has therefore been used to systematically study some of the possible multi-parameter interactions that influence thermal feedback. This paper discusses some of the most significant influences in this regard, and attempts to establish a simplified correlation that illustrates, on a closed mathematical form, their combined impact on fuel performance, especially in the context of an overpower event. This correlation is intended to assist in developing an improved overview of the integrated effect of various performance details. The principal physical mechanisms thus discussed are the transient diffusion from grains to boundaries, as influenced by the presence of a varying re-solution barrier, the release from grain boundaries by tunneling and surface diffusion, and the influence on the grain boundary capacity of mechanical constraint. The discussion is referred to a single-grain scenario. Such effects as the enhancement of thermal feedback by axial mixing delays are therefore not discussed here. (author). 4 refs, 2 figs.

5142 (IWGFPT–32, pp. 313-318) **Thermophysical design model used in START-3 code.** Medvedev, A.V. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Neorganicheskikh Materialov, Moscow (USSR)); Kulakov, F.G. International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology. May 1989. (CONF-8809420–: Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions, Preston (UK), 18-22 Sep 1988). In *Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988.* Order Number DE90610159. Available from NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS.

The paper describes in general terms fuel restructuring and fission gas behaviour models included in the full START-3 fuel design code. The models have been developed on the principles of the maximum complete representation of the physical processes and meant for versatile application to standard and prototype fuels. Some aspects of FG behaviour in fuel are illustrated; by comparing with experimental data the general ability of the code to model credibility gas release is shown. (author). 7 refs, 4 figs, 1 tab.

2204 Control Systems

Refer also to citation(s) 5195, 5210

5143 (CEGB-RD/L–3365/R88) **CUTLASS database facilities.** Jervis, P.; Rutter, P. Central Electricity Research Labs., Leatherhead (UK). Sep 1988. 13p. Order Number DE90610151. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The enhancement of the CUTLASS database management system to provide improved facilities for data handling is seen as a prerequisite to its effective use for future power station data processing and control applications. This particularly applies to the larger projects such as AGR data processing system refurbishments, and the data processing systems required for the new Coal Fired Reference Design stations. In anticipation of the need for improved data handling facilities in CUTLASS, the CEGB established a User Sub-Group in the early 1980's to define the database facilities required by users. Following the endorsement of the resulting specification and a detailed design study, the database facilities have been implemented as an integral part of the CUTLASS system. This paper provides an introduction to the range of CUTLASS Database facilities, and emphasises the role of Database as the central facility around which future Kit 1 and (particularly) Kit 6 CUTLASS based data processing and control systems will be designed and implemented. (author).

5144 (CONF-8911123–1) **Research and development on the application of advanced control technologies to advanced nuclear reactor systems: A US national perspective.** White, J.D. (Oak Ridge National Lab., TN (USA)); Monson, L.R.; Carrol, D.G.; Dayal, Y. Oak Ridge National Lab., TN (USA). [1989]. 28p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. From IAEA Technical Committee workshop on the impact of advanced technologies on reactor systems; Vienna (Austria); 6-9 Nov 1989. Order Number DE90002939. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Control system designs for nuclear power plants are becoming more advanced through the use of digital technology and automation. This evolution is taking place because of: (1) the limitations in analog based control system performance and maintenance and availability and (2) the promise of significant improvement in plant operation and availability due to advances in digital and other control technologies. Digital retrofits of control systems in US nuclear plants are occurring now. Designs of control and protection systems for advanced LWRs are based on digital technology. The use of small inexpensive, fast, large-capacity computers in these designs is the first step of an evolutionary process described in this paper. Under the sponsorship of the US Department of Energy (DOE), Oak Ridge National Laboratory, Argonne National Laboratory, GE Nuclear Energy and several universities are performing research and development in the application of advances in control theory, software engineering, advanced computer architectures, artificial intelligence, and man-machine interface analysis to control system design. The target plant concept for the work described in this paper is the Power Reactor Inherently Safe Module reactor (PRISM), an advanced modular liquid metal reactor concept. This and other reactor designs which provide strong passive responses to operational upsets or accidents afford good opportunities to apply these advances in control technology. 18 refs., 5 figs.

5145 (ETDE-IT–89-32) **Model qualification of a nuclear power plant engineering simulator.** Cori, R.; Perugia, A.; Pretolani, F.; Serra, M. ENEA, Casaccia (Italy). Centro Ricerche Energia; Ente Nazionale per l'Energia Elettrica, Milan (Italy). Sep 1987. 8p. Order Number DE90724719. Available from NTIS (US Sales Only), PC A02/MF A01.

This paper presents the qualification program of an engineering simulator for Italian nuclear power plants (PWR-PUN). With the aim of analyzing normal and accidental transients, the engineering simulator reproduces in real time, plant behaviour upon which a technician or engineer can act during transient evolution. This device is also expected to fulfill the gap that currently exists between the full replica training simulators and the simulation engineering batch codes. In order to assess simulator validity and accuracy a qualification program was undertaken based on a comparison of response between the simulator and two plant reference models, built by best-estimate engineering codes. The program consists of four phases: component level; module integration level; whole simulator; application orientation. The qualification criteria are based on EPRI recommendations, enhanced specifically for the use of the simulator. The first qualification phase is currently in progress. The available results, relating to the pressurizer, are included and briefly discussed.

5146 (ETDE-IT–89-35) **Software measurement - what and how. An application in the field of safety software for power plant.** Bologna, S. ENEA, Casaccia (Italy). Centro Ricerche Energia. Dec 1987. 15p. (In Italian). Order Number DE90724717. Available from NTIS (US Sales Only), PC A03/MF A01.

The importance of quality metrics technology to provide a more disciplined engineering approach to specifying, predicting and evalutating software quality, is widely recognized. To ensure consistent application of the concept of quality metrics, several pragmatic issues connected to the concept of measurement (such as what to measure, how to measure, when to measure, how to use data) should be resolved prior to the practical application of the quality metrics technology. This paper, after an introduction to the problems/benefits of measurement, reports some instances of software measurements made possible with technology available today. The application we consider, is an embedded system with safety functions, in which reliability is of the utmost importance.

5147 (ETDE-IT–89-38) **Testing of a hardware unit of a nuclear power plant protection system. The IEEE 796 bus.** Bologna, S.; Minichino, M.; Del Corso, D.; Pasero, E.; Maddaleno, F. ENEA, Casaccia (Italy). Centro Ricerche Energia; Politecnico di Torino, Turin (Italy). Dec 1987. 9p. Order Number DE90724718. Available from NTIS (US Sales Only), PC A02.

The Integrated Protection System (IPS) is intended for Italian (PWR type) nuclear power plants. The IPS is based on a distributed microprocessor system architecture, and is designed to be highly reliable. The reliability is assured through the use of redundancy and functional diversity. Failures that, in spite of redundancy, can impair the system are Common Mode Failures (CMFs). CMF evaluation, in safety related microprocessor control systems, are by no means a novel subject. In particular, the IEEE 796 microprocessor bus represents, in the IPS architecture, a common hardware unit along the IPS redundant channels and is therefore a possible source of CMFs. The IPS prototype development project is under Westinghouse's responsibility and has the participation of various Italian organizations, each contributing in different areas of expertise. Within this framework, ENEA (Italy) leads all the research activities that are conducted in Italy to improve knowledge on microprocessor technologies to be used in nuclear power plant control systems. This paper presents the results of the testing strategies and the measurements used to test the IEEE 796 bus, as a common unit along the redundant channels of the IPS. These activities were carried out in the framework of the cooperation between ENEA and Politecnico di Torino on microprocessor technologies.

5148 (ETDE-IT–89-40) **Plant monitoring system design: Italian BWR NPP and future trends in man-machine interface.** Maestri, F.; Sepielli, M. Ansaldo S.p.A., Genoa (Italy); ENEA, Casaccia (Italy). Centro Ricerche Energia. May 1987. 25p. (CONF-8705397–: Specialists' meeting on the human factor information feedback in nuclear power - implications of operating experience on system analysis, design and operation, Roskilde (Denmark), 25-27 May 1987). Order Number DE90724720. Available from NTIS (US Sales Only), PC A03.

Paper presented at specialists' meeting on the human factor information feedback in nuclear power - Implications of operating experience on system analysis, design and operation, Roskilde (Denmark), 25-27 May 1987.

The TMI accident sequence and daily operating experience, gained at Italian and other NPPs worldwide, have deeply affected the approach to the design of information channeling to the control room staff. It is now clear that most problems in plant operation arise from a poor and inadequate information system. The main deficiencies have been found in the control room layout and in information organization. This has pushed designers to improve the control room environment and to better exploit computer data processing and data channeling capabilities. This paper deals with the basic criteria for the desing and design review of a computerized system to be inserted in a hybrid control room in an Italian 981 Mwe BWR-6 NPP, in which the concepts outlined above were taken up from the very beginning. The control room keeps conventional instrumentation arranged in a human-factor layout, according to post-TMI requirements, and adds a powerful computer based information system, with high data reliability for advanced warning signalling and plant supervision during normal and emergency conditions. Colour video units and operating panels are functionally integrated to created powerful operator work stations. Emphasis is given to the revision work for video unit displays and man-system communication carried out in cooperation with the Halden Reactor Project human factor and plant operation experts. In this work, great care is given to the integration between conventional and computerized information presentation, with particular regard to common information and code consistency.

5149 (IWGGCR–19, pp. 80-85) **Approach to multimodule control of the MHTGR.** Woodworth, C.M. (Stone and Webster Engineering Corp., Boston, MA (USA)); Rodriguez, C.; Starr, T.M. International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989. (CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). In *Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.* Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

This paper describes the advanced instrumentation and control technology that has been applied to the modular high-temperature gas-cooled reactor (MHTGR) to meet the top-level goal of safe, economical power. The MHTGR, with its four reactor modules and two turbine generators, will be controlled to respond to a variety of normal and transient operating modes. The overall objective of the plant control, data, and instrumentation system (PCDIS) function is to assist plant operations personnel in maintaining highly reliable control of the MHTGR. The MHTGR design simplicity and passive response, in conjunction with the plant supervisory control system, have yielded a major reduction in operator workload. The plant does not require safety-related operator actions, nor does it require the control room or its equipment to be safety related. Therefore, plant control is accomplished from a central control room by two operators and one supervisor via the supervisory control system. (author). 5 figs.

5150 (NUREG/CR–5422) **Performance of the liquid reactivity control system in BWRs [boiling water reactors].** Theofanous, T.G. (California Univ., Santa Barbara, CA (USA). Dept. of Chemical and Nuclear Engineering); Shabana, E.A. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications; California Univ., Santa Barbara, CA (USA). Dept. of Chemical and Nuclear Engineering. Sep 1989. 65p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A04/MF A01 - GPO; OSTI; INIS.

Boiling water reactors rely on the injection of soluble neutron absorbers to control power in case of failure in the control rod (scram) system. Typically this liquid "poison" is injected from eight small holes on a standpipe positioned vertically near the outer edge of the core shroud in the lower plenum. The achievement of control is predicated on good mixing of this injected liquid with the coolant which is recirculating around the core upper plenum and downcomer. However, because the flows are rather low (~20% of rated with pumps tripped as expected under such conditions) and the injected solution density is much higher than that of the primary fluid, there have been concerns raised about the efficiency and completeness of this mixing. This work provides the first openly available data addressing such concerns. To avoid potentially important scaling compromises, the data were obtained from full-scale simulations. From the experiments performed so far, we can conclude that complete boron mixing (entrainment) will occur for recirculation flow rates down to 8.2% of rated. 3 refs., 60 figs., 2 tabs.

5151 (UFRJ-COPPE-GAPS–06/83) **Review of the reliability analysis of LPRS including the components repairs.** Oliveira, L.F.S. de; Fleming, P.V.; Frutuoso e Melo, P.F.F.; Tayt-Sohn, L.C. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1983. 62p. (In Portuguese). Order Number DE90608661. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

The reliability analysis of low pressure recirculation system in its long-term recirculation phase before 24hs is presented. The possibility of repairing the components out of the containment is included. A general revision of analysis of the short-term recirculation phase is done. (author).

5152 **Diffusion theory calculations for the pin-wise power distribution in VENUS-I and VENUS-II.** Williams, M.L. (Louisiana State Univ., Baton Rouge, LA (USA). Nuclear Science Center); Marshall, G.M.; Chowhury, P.; Kam, F.B.K. pp. 798 of Reactor dosimetry: Methods, applications, and standardization. Farrar IV, H.; Lippincott, E.P. ASTM, Philadelphia, PA (1989). (CONF-870501–: 6. ASTM-Euratom symposium on reactor dosimetry: methods, applications, and standardization, Jackson Hole, WY (USA), 31 May - 5 jun 1987).

Standard pressurized water reactor (PWR) calculation procedures based on two-group diffusion theory are used to compute the relative pin-power distribution in the VENUS-I and VENUS-II benchmark configurations. These two critical lattices simulate PWR cores which have fresh (UO_2) and uranium/plutonium (MO_2) pins on the core

periphery, respectively. The purpose of the study is to establish the accuracy of these methods, which are used to obtain the core source distribution for RPV fluence calculations, by comparing the calculated with experimentally determined relative power variation. Special consideration is given to the core periphery region, which contributes most heavily to the RPV fluence. It is found that the diffusion calculations agree to within 5 to 10% of the measurements for both the uranium and MO_2 cores. It is estimated that this order of source discrepancy will cause only about 5% uncertainty in the computed RPV fluence.

5153 **Application of LEPRICON methodology to LWR pressure vessel surveillance dosimetry.** Maerker, R.E. (Oak Ridge National Lab., TN (USA)). pp. 798 of Reactor dosimetry: Methods, applications, and standardization. Farrar IV, H.; Lippincott, E.P. ASTM, Philadelphia, PA (1989). DOE Contract AC05-84OR21400. (CONF-870501–: 6. ASTM-Euratom symposium on reactor dosimetry: methods, applications, and standardization, Jackson Hole, WY (USA), 31 May - 5 jun 1987).

An example of applying the LEPRICON methodology to an existing pressurized water reactor is described. The present application is an analysis of ad hoc dosimetry inserted into the H.B. Robinson-2 reactor to monitor the effects on pressure vessel fluence produced by the introduction of a low-leakage fuel management scheme during Cycle 9. The use of simultaneous dosimetry at both a downcomer location and in the reactor cavity allows a quantitative evaluation to be made by the LEPRICON procedure of the relative merits of each location; the cavity location is found to be superior. Unfolded results using the dosimetry indicate that the cumulative neutron fluence above 1.0 MeV originally calculated for the critical lower circumferential weld in the pressure vessel during Cycle 9, 7.2×10^{17} n/cm^2 +- 15.9%, should be adjusted upward by about one standard deviation to a value of 8.8×10^{17} n/cm^2 with a reduced uncertainty of 10.9%.

5154 **SPECOMP calculations of radiation damage in compounds.** Greenwood, L.R. (Argonne National Lab., IL (USA). Chemical Technology Div.). pp. 798 of Reactor dosimetry. Farrar IV, H.; Lippincott, E.P. ASTM, Philadelphia, PA (1989). (CONF-870501–: 6. ASTM-Euratom symposium on reactor dosimetry: methods, applications, and standardization, Jackson Hole, WY (USA), 31 May - 5 jun 1987).

A new computer code SPECOMP has been developed to calculate displacement damage for compound materials. The code uses primary recoil atom energy distributions from the SPECTER code and thus requires no access to nuclear data bases. For each combination of recoil and matrix atom, the code determines the secondary displacement functions and integrates over the recoil energy distributions. The net displacements for a compound are then the weighted sum of these results for all combinations of atoms in the compound. Calculations have been completed for fusion tritium breeders, insulators, and alloys. In cases where there are large mass differences between atoms in the compound, the damage calculated by SPECOMP is significantly different than the weighted sum of elemental damage from SPECTER. Displacement functions for various materials are being added to the SPECTER package for routine use, and SPECTER users can easily perform calculations for new compounds.

5155 **Design and use of the Embrittlement Data Base (EDB).** Stallmann, F.W. (Oak Ridge National Lab., TN (USA)). pp. 798 of Reactor dosimetry: Methods, applications, and standardization. Farrar IV, H.; Lippincott, E.P. ASTM, Philadelphia, PA (1989). DOE Contract AC05-84OR21400. (CONF-870501–: 6. ASTM-Euratom symposium on reactor dosimetry: methods, applications, and standardization, Jackson Hole, WY (USA), 31 May - 5 jun 1987).

The architecture of the Embrittlement Data Base (EDB) is described. This data base contains a comprehensive collection of experimental data related to irradiations of reactor pressure vessel steels in surveillance capsules and test reactors. Software is being developed for easy retrieval and analysis of the data. Data and software will be made available on a cooperative basis.

5156 **Determination of gamma-ray-induced displacement rates.** Gold, R. (Westinghouse Hanford Co., Hanford Engineering Development Lab., Richland, WA (US)); Doran, D.G.; Roberts, J.H. pp. 798 of Reactor dosimetry: Methods, applications, and standardization. Farrar IV, H.; Lippincott, E.P. ASTM, Philadelphia, PA (1989). (CONF-870501–: 6. ASTM-Euratom symposium on reactor dosimetry: methods, applications, and standardization, Jackson Hole, WY (USA), 31 May - 5 jun 1987).

To define the gamma-ray component of the radiation field in light water reactor (LWR) pressure vessel (PV) environments, gamma-ray spectrometry experiments were conducted in the low power PV mockup at the poolside critical assembly (PCA) at the Oak Ridge National Laboratory (ORNL). Gamma-ray displacement rates can be calculated directly from absolute electron spectra observed with the Janus probe gamma-ray spectrometry. Gamma-ray displacement results are presented for the 1/4-T, 1/2-T, and 3/4-T locations of the 12/13 and 4/12 simulated surveillance capsule (SSC) configurations. In addition, the gamma-ray displacement rate at the SSC location was inferred using thermoluminescent dosimeter (TLD) gamma-ray dosimetry results obtained in the 4/12 SSC configuration at the PCA. Compared with neutron-induced displacement rates, the calculated gamma-ray-induced displacement rates are small at all these LWR-PV locations. The ratio of gamma-ray-induced to neutron-induced displacement rates never exceeds roughly 5×10^{-3}.

5157 **Correction of burn-in effects in fission neutron dosimeters.** Gold, R. (Hanford Engineering Development Lab., Westinghouse Hanford Co., Richland, WA (US)); McElroy, W.N. pp. 798 of Reactor dosimetry: Methods, applications, and standardization. Farrar IV, H.; Lippincott, E.P. ASTM, Philadelphia, PA (1989). (CONF-870501–: 6. ASTM-Euratom symposium on reactor dosimetry: methods, applications, and standardization, Jackson Hole, WY (USA), 31 May - 5 jun 1987).

When fission neutron dosimeters are applied for neutron dosimetry, such as those used in light-water reactor (LWR) pressure vessel surveillance (PVS), higher order actinide isotopes can be produced in the dosimeter by the neutron field. These higher order actinide isotopes can also undergo fission and thereby contribute to the number of fissions or fission rate that is observed with the dosimeter. This so-called burn-in effect can be non-negligible. A method for correction of this burn-in effect is advanced. In this new method, two quantities are measured in order to quantify the burn-in contribution, namely the amount of the in-grown fissile isotope that is created and the fissions per unit volume reduced in the in-grown fissile isotope. Monitors used to measure these two quantities must experience the very irradiation that the fission neutron dosimeter undergoes. Conditions are defined under which the burn-in effect can be delineated. Advantages of this correction method are discussed.

2205 Environmental Aspects

Refer also to citation(s) 4770, 5174, 5188, 5190, 5194, 5240, 5819, 5833, 5864, 5865, 5866, 5867, 5868, 5869, 5879

5158 (CEGB-RD/B–6079/R88) **Quality assurance of the computer code INDAR.** Wilmott, S. Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs. Dec 1988. 35p. (ODMWG/P–(88)13). Order Number DE90609913. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Detailed aquatic dispersion and radiation exposure models are required in order to assess the radiological impact of routine aquatic discharges from nuclear power stations in the United Kingdom. Such models have been developed and incorporated in the computer program INDAR. This report describes the quality assurance procedures adopted in producing and testing the first release of the code, which was complied in November 1988 and is currently stored in the production load module PROD.INDAR.V10. (author).

5159 (INIS-BR–1757) **Importante of physical and mathematical models for nuclear power plants site selection.** Rios, J.L.P. (Universidade Catolica de Petropolis, RJ (Brazil)). Universidade Federal, Rio de Janeiro, RJ (Brazil). 1989. 13p. (In Portuguese). (CONF-8907173–: 3. Brazilian congress on Defense of the Environment, Rio de Janeiro (Brazil), 24-28 Jul 1989). Order Number DE90608323. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The importance of the release of effluents from nuclear installations for the site selection of nuclear power plants is discussed. The

main available analysis methods, physical and mathematical, is presented.

5160 (INIS-mf–11562, pp. 45) **Radiometric determination of transuranium actinides present in contaminants at A-1 nuclear power plant.** Minarik, F.; Fueloep, M.; Vladar, M.; Lahham, A.; Szlaurova, M.; Vano, S.; Soos, F. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. TRANSURANIUM ELEMENTS/ alpha spectroscopy; ACTIVITY LEVELS; BOHUNICE A-1 REACTOR; CONTAMINATION; SAMPLE PREPARATION

5161 (INIS-mf–11562, pp. 24) **Results of three-year long monitoring of ^{239,240}Pu and ^{238}Pu concentrations in gaseous effluents of V-1 nuclear power plant with WWER-440 reactors at Jaslovske Bohunice.** Hoelgye, Z. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni); Filgas, R.; Peskova, V. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. BOHUNICE V-1 REACTOR/ radioactive effluents; GASEOUS WASTES/radiation monitoring; PLUTONIUM 238; PLUTONIUM 239; PLUTONIUM 240

5162 (INIS-mf–11562, pp. 25) **Results of thre-year long monitoring of ^{90}Sr in gaseous effluents of V-1 nuclear power plant with WWER-440 reactors at Jaslovske Bohunice.** Hoelgye, Z. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni); Peskova, V.; Brezik, Z.; Pickova, L. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. BOHUNICE V-1 REACTOR/ radioactive effluents; STRONTIUM 90/radiation monitoring; GASEOUS WASTES

5163 (INIS-mf–11562, pp. 31) **Project of information system for monitoring radioactive material escape into environment.** Kliment, V. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni). Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. RADIATION MONITORING/ information systems; DATA ACQUISITION; DATA PROCESSING; ENVIRONMENT; RADIATION ACCIDENTS; RADIOACTIVE EFFLUENTS

5164 (INIS-mf–11562, pp. 33) **Calculations for teledosimetry system of Temelin nuclear power plant.** Konecny, J. (Ceskoslovenska Akademie Ved, Ceske Budejovice (Czechoslovakia). Ustav Krajinne Ekologie); Singer, J.; Kluson, J.; Musilek, L. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. TEMELIN-1 REACTOR/ dosimetry; MATHEMATICAL MODELS; OPTIMIZATION; RADIATION DOSES; RADIATION MONITORING; DOSIMETRY

5165 (IWGGCR–19, pp. 176-182) **Environmental aspects of MHTGR operation.** Neylan, A.J. (General Atomics, San Diego, CA (USA)); Dilling, D.A.; Cardito, J.M. International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors; Commission of the European Communities, Brussels (Belgium); Nuclear Energy Agency, 75 - Paris (France). Jun 1989. (CONF-8809150–: IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors, San Diego, CA (USA), 21-23 Sep 1988). In *Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988.* Order Number DE90608752. Available from NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS.

The Modular High-Temperature Gas-Cooled Reactor (MHTGR) is an advanced reactor concept being developed under a cooperative program involving the U.S. Government, the utilities and the nuclear industry. This plant design utilizes basic High Temperature Gas-Cooled Reactor (HTGR) features of ceramic fuel, helium coolant, and a graphite moderator. The MHTGR design approach leading to exceptional safety performance also leads to plant operation which is characterized by extremely low radiological emissions even for very low probability accidents. Coated fuel particles retain radionuclides within the fuel, thus minimizing material contamination and personnel exposure. The objective of this paper is to characterize radioactive effluents expected from the normal operation of an MHTGR. In addition, other nonradioactive effluents associated with a power generating facility are discussed. Nuclear power plants produce radioactive effluents during normal operation in gaseous, liquid and solid forms. Principal sources of radioactive waste within the MHTGR are identified. The manner in which it is planned to treat these wastes is described. Like other reactors, the MHTGR produces nonradioactive effluents associated with heat generation and chemical usage. However, due to the MHTGR's higher efficiency, water usage requirements and chemical discharges for the MHTGR are minimized relative to other types of nuclear power plants. Based upon prior operating HTGR experience and analysis, effluents are quantified in terms of radioactivity levels and/or emission volume. Results, quantified within the paper, demonstrate that effluents from the MHTGR are well below regulatory limits and that the MHTGR has a minimal impact upon the public and the environment. (author). 14 refs, 2 figs, 3 tabs.

2206 Research, Test, and Experimental Reactors

Refer also to citation(s) 4900, 4901, 4902, 5014, 5015, 5018, 5103, 5154, 5155, 5186, 5191, 5192, 5195, 5208, 5630

5166 (CONF-8909141–6) **Postirradiation examination of ORR [Oak Ridge Research Reactor] demonstration elements.** Snelgrove, J.L. (Argonne National Lab., IL (USA)); Copeland, G.L.; Hofman, G.L. Argonne National Lab., IL (USA). 1989. 24p. Sponsored by U.S. Arms Control and Disarmament Agency; U.S. DOE Assistant Secretary for International Affairs and Energy Emergencies. DOE Contract W-31109-ENG-38. From 12. international meeting on reduced enrichment for research and test reactors; Berlin (Germany, F.R.); 10-13 Sep 1989. Order Number

DE90001430. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Postirradiation examinations of selected U_3Si_2 fuel elements fabricated by B&W, CERCA, and NUKEM and irradiated during the whole core demonstration in the Oak Ridge Research Reactor are nearing completion. The results of all tests have shown the demonstration fuel elements, produced under production-line conditions, to have performed in the excellent manner expected from earlier tests of miniature fuel plates and full-sized elements. 8 refs., 20 figs., 1 tab.

5167 (EGG-M–88339) **The advantages and disadvantages of using the TREAT [Transient Reactor Test Facility] reactor for nuclear laser experiments.** Dickson, P.W. (EG and G Idaho, Inc., Idaho Falls, ID (USA)); Snyder, A.M.; Imel, G.R.; McConnell, R.J. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1989]. 13p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-891255–1: 11. international conference on lasers and applications, Lake Tahoe, NV (USA), 4-9 Dec 1989). Order Number DE90002018. Available from NTIS, PC A03/MF A01; OSTI; INIS.

TREAT (Transient Reactor Test Facility) is a large, air-cooled test facility located at the Idaho National Engineering Laboratory (INEL). This facility was originally designed to evaluate reactor fuels and structural materials under conditions simulating various types of nuclear excursions and transient undercooling situations. However, for several reasons it lends itself well to supporting a variety of nuclear laser experiments. Two of the major design features of TREAT – its large size and its being an air-cooled reactor – provide the clues to both its advantages and disadvantages for supporting nuclear laser experiments. Its large size, which is dictated by the dilute uranium/graphite fuel, permits accommodation of geometrically large experiments. However, TREAT's large size also results in relatively long transients so that the energy deposited in an experiment is large relative to the peak power available from the reactor. TREAT's air-cooling mode of operation allows its configuration to be changed fairly readily. Not only can individual fuel elements be removed to admit a large test article but, perhaps more importantly, special slotted elements can be installed in line with removable shield plugs to provide line-of-sight access through the reactor. For the same reason – air cooling – the reactor cools down slowly, permitting only one full power transient a day which can be a disadvantage in some experimental programs. In addition, the reactor is capable of both steady-state or transient operation. 10 figs., 1 tab.

5168 (INIS-BR–1684) **Measurement and calculation of spatial and energetic neutron flux in the IEA-R1 reactor core.** Bittelli, U.D. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). 1988. 133p. (In Portuguese). Order Number DE90608647. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

This work presents spatial and energetic flux distribution measured in the IEA-R1 reactor core. The thermal neutron flux was measured by gold activation foils (bare and covered with cadmium) in the fuel element number 108 (reaction: $^{197}Au(n,\gamma)^{198}Au$) at 451W overall reactor power. The fast neutron flux was measured by indium activation foils (reaction: $^{115}In(n,n')^{115m}In$) in the fuel elements number 94 at 4510W overall reactor power. The neutron energy spectrum was adjusted by SAND II code with the data produced by the irradiation of seven activation detectors in the fuel element number 94 at 4510 W overall reactor power. The following reactions were used: $^{58}Fe(n,\gamma)^{59}Fe$, $^{232}Th(n,\gamma)^{233}Th$, $^{197}Au(n,\gamma)^{198}Au$, $^{59}Co(n,\gamma)^{60}Co$, $^{54}Fe(n,p)^{54}Mn$, $^{24}Mg(n,p)^{24}Na$,$^{47}Ti(n,p)^{47}Sc$, $^{48}Ti(n,p)^{48}Sc$ and $^{115}In(n,n')^{115m}In$. The experimental results compared to those obtained by CITATION (spatial distribution flux) and HAMMER (energetic distribution flux) code, showed good agreement. The results presented in this work are a good contribution for a better knowledge of spatial and energetic neutron flux distribution in the IEA-R1 reactor core, besides that the experimental procedure is easily applicable to another situations. (autor).

5169 (NEI-NO–96) **On the search for uranium. Institutt for atomenergi and international cooperation 1945-51.** Forsvarsstudier. no. 3/87. Forland, A. Forsvarshistorisk Forskningssenter, Oslo (Norway). 1987. 40p. (In Norwegian). Order Number DE90610396. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Forsvarsstudier.; no. 3/87.; Summary in English.

The research reactor JEEP, which was completed in 1951 at Institutt for atomenergi (IFA), Kjeller, Norway, became the first reactor in the world to be built outside the big-power states. Due to Norwegian production of heavy water, the reactor was constructed as a heavy water reactor using natural uranium as fuel. A graphite reflector surrounded the reactor tank. Both uranium and graphite had to be purchased abroad. Because of the Anglo-American monopoly of all sizable uranium sources in the Western part of the world, no uranium for the reactor was available on the free market. The present study analyses Norway's and IFA's foreign relations at the time of the reactor project, and focuses in particular on the choice of the future partner that IFA had to make in order to solve its uranium problem. Political considerations were among the factors behind the decision in 1951 to establish a joint Dutch-Norwegian atomic energy research institute.

5170 (NEI-NO–97) **Atoms for war or peace?. The establishment of the Norwegian Institutt for atomenergi 1945-1948.** Forsvarsstudier. no. 2/88. Forland, A. Institutt for Forsvarsstudier, Oslo (Norway). 1988. 45p. (In Norwegian). Order Number DE90610397. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Forsvarsstudier.; no. 2/88.; Summary in English.

The first nuclear reactor built in Norway was a 100 kW experimental reactor which was put into operation at Kjeller in 1951. After the Ministry of Defence had granted 5 millions Nkr for the purpose of building a small research reactor, Institutt for atomenergi was established in 1947. The planning of the project took place at the Norwegian Defence Research Establishment. The main purpose of this study is to explain why a small power like Norway went ahead with a nuclear reactor project at the outset of the post-war period: How was it possible for Norway to undertake nuclear energy research, and what were the reasons for doing it?.

2207 Plutonium and Isotope Production Reactors

Refer also to citation(s) 4903, 5207, 5455, 5612, 6394

5171 (INIS-BR–1711) **Study of the production conditions of ^{99}Mo from the irradiation of uranium dioxide in a radioisotope production reactor.** Couto, R.T.; Brito Aghina, L.O.; Renke, C.A.C. Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil). Dept. de Reatores. [1989]. 1p. (In Portuguese). Order Number DE90608650. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. URANIUM DIOXIDE/irradiation; H CODES; MOLYBDENUM 99; NEUTRON FLUX; NUCLEAR FUELS; PRODUCTION REACTORS; IRRADIATION; Z CODES

2208 Propulsion Reactors

Refer also to citation(s) 6388

2209 Reactor Safety

Refer also to citation(s) 5006, 5013, 5014, 5038, 5106, 5128, 5144, 5150, 5152, 5261, 5263, 5369, 5656, 5765, 5830, 5891, 5893, 5932, 5933, 5949, 6194, 6195, 6196, 6214

5172 (AEEW-R–2318) **Effect of bed non-uniformities and porosity of particles on dryout in boiling particle beds.** Macbeth, R.V.; Mogford, D.J.; Willshire, S.J. UKAEA Atomic Energy Establishment, Winfrith (UK). Safety and Engineering Science Div. Mar 1988. 23p. Order Number DE90608654. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This report relates to an on-going experimental programme concerned with the coolability of beds of reactor core debris or rubble immersed in a liquid coolant, as might occur in an accident situation. The objectives are to develop experimental techniques, improve the understanding of bed cooling mechanisms, determine dry-out limitations of various bed configurations and particle shapes and sizes and devise ways of improving bed coolability. The report concentrates on a recently discovered effect on bed coolability of particle porosity, such as exists in fragmented UO_2 fuel pellets. It is

shown that porosity can lower bed dry-out powers by a factor of 4 or 5. A mechanism which explains the effect is presented. The report also gives results of bed non-uniformities obtained by mixing glass particles with the dielectrically heated 'ferrite' particles used in the experiments. (author).

5173 (BNL-NUREG–43090) **Core damage vulnerability due to the loss of ESW [essential service water] systems at multiplant sites: An assessment and options.** Kohut, P. (Brookhaven National Lab., Upton, NY (USA)); Musicki, Z.; Fitzpatrick, R. Brookhaven National Lab., Upton, NY (USA). [1989]. 12p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC02-76CH00016. (CONF-8911111–1: Service water systems reliability improvement seminar, Charlotte, NC (USA), 6-8 Nov 1989). Order Number DE90002589. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The main objective of this study is to establish the core damage vulnerability caused by the failure of the ESW systems in multiplant units that have only two sw pumps per unit with crosstie capability. Design and operating data have been surveyed to derive system failure frequency. A core damage model is constructed including operating configurations, specific recovery actions, and time and leak rate dependent RCP seal LOCA model. The estimated CDF_{SW} = 2.55×10^{-4}/yr is significant indicating the potential vulnerability of this particular SW design arrangement. A number of different potential improvements have been considered. The addition of a swing pump serving both units is shown to have the most significant CDF reduction potential (~50%) combined with advantageous cost/benefit aspects. 2 refs., 2 tabs.

5174 (CEGB-RD/B–6091/R88) **Criteria and measurement techniques applicable to residual radioactivity on a decommissioned reactor site.** Woollam, P.B. Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs. Dec 1988. 17p. Order Number DE90610116. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This document summarises the radiological criteria which might be developed to cover the release of a partly decommissioned nuclear reactor site, then looks at the techniques available by which the site could be monitored to assure compliance with these criteria. In particular, the implications of existing levels of radioactive contamination resulting from airburst nuclear weapons tests and the Chernobyl accident are discussed. (author).

5175 (CLM-R–291) **Some computations of detonations using the CULDESAC code.** Fletcher, D.F. UKAEA Culham Lab., Abingdon (UK). Mar 1989. 19p. Available from H.M. Stationery Office, London, price Pound 8.00.

In this paper we present the results of a series of computations performed using the CULDESAC code. CULDESAC is a multiphase detonation model which is being developed in order to understand the detonation phase of a vapour explosion. The paper contains the results of a limited parameter survey and simulations for inhomogeneous initial coarse mixtures. We discuss the relevance of the results obtained to experimental data on vapour explosions and we also consider the importance of modelling non-equilibrium effects in detonations. Finally, we present an overview of the status of detonation modelling. (author).

5176 (CONF-891103–42) **Detector effects in ^{252}Cf-source-driven noise analysis measurements.** Mihalczo, J.T.; Blakeman, E.D.; Pare, V.K. Oak Ridge National Lab., TN (USA). [1989]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Winter meeting of the American Nuclear Society; San Francisco, CA (USA); 26-30 Nov 1989. Order Number DE90003054. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Detector effects in the ^{252}Cf-source-driven noise measurements of subcriticality are important not only for planning experiments but for interpretation of the data. The detectors must be of a type and location such that the assumptions of the theory used to interpret the data are valid. Although a general theory will be helpful for fully understanding the method, point kinetics with simple corrections will be used for practical in-plant applications. The validity of the assumption of independence of reactor noise and detection noise was verified by reinterpreting the data for an experiment where k varied from 0.95 to 0.35 with the assumption that reactor noise and detection noise are correlated. This correlated assumption produced k values that were as much as a factor of 2 higher at k = 0.35, assuming independence of detection and reactor noise. The values with the uncorrelated assumption agreed with independent break frequency noise analysis measurements and calculations. 17 refs., 2 figs.

5177 (DOE-tr–89-9) **Trends in development of probability assessment of nuclear power plant safety.** (Vyvoje tendence v metode pravdepodobnostniho oceneni bezpecnosti jadernych elektraren). Dach, K. (Ceskoslovenska Akademie Ved, Rez (Czechoslovakia). Ustav Jaderne Fyziky). USDOE, Washington, DC (USA). [1989]. 15p. Translated from Safety and Operating Reliability of Reactor WWER (External Load), Czechoslovak Commission on Atomic Energy, Prague, 1987. Sponsored by U.S. DOE Management & Administration. (CONF-8611245–1: 5. seminar on safety and operating reliability of reactor WWER, Marianske Lazne (Czechoslovakia), 5-6 Nov 1986). Order Number DE90002741. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A complete study of probability safety assessment (PSA) of nuclear power plants is a multidisciplinary endeavor, requiring a qualified decision-making team composed of experienced professionals in individual disciplines and requiring good coordination of effort. The main concerns for the execution of a PSA study and related tasks are schematically presented. Also shown is a summary of the main steps for a PSA study at all three levels, with the incorporation of analysis of external events and the reliability of humans, including the necessary uncertainty analyses. 1 ref., 2 figs., 3 tabs.

5178 (EGG-M–88175) **TMI-2 degraded core heatup and cooldown analysis.** Moore, R.L.; Golden, D.W.; Tolman, E.L. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1988. 35p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-881024–20: TMI-2 accident materials behavior, plant technology and recovery, Washington, DC (USA), 30 Oct - 4 nov 1988). Order Number DE90002034. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper is concerned with modeling the TMI-2 core heatup between 174 min and 224 min using a two-dimensional finite element model with simulated molten pool convection. We present a brief description of the model and then present results illustrating the effect that initial core temperatures (174 min) and decay heat levels have on the end state geometry at 224 min. Results for the cooling of the consolidated core region after the relocation event (224 min) are also presented. 17 refs., 11 figs., 2 tabs.

5179 (EGG-M–88177) **Sampling and examination methods used for TMI-2 samples.** Marley, A.W.; Akers, D.W.; McIsaac, C.V. EG and G Idaho, Inc., Idaho Falls, ID (USA). 1988. 32p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-881024–19: TMI-2 accident materials behavior, plant technology and recovery, Washington, DC (USA), 30 Oct - 4 nov 1988). Order Number DE90002000. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The purpose of this paper is to summarize the sampling and examination techniques that were used in the collection and analysis of TMI-2 samples. Samples ranging from auxiliary building air to core debris were collected and analyzed. Handling of the larger samples and many of the smaller samples had to be done remotely and many standard laboratory analytical techniques were modified to accommodate the extremely high radiation fields associated with these samples. The TMI-2 samples presented unique problems with sampling and the laboratory analysis of prior molten fuel debris. 14 refs., 8 figs.

5180 (ENEA-RT-PAS–89-02) **Radiological characterization of decommissioned nuclear plants: Problems and experience in Italy.** Mincarini, M. ENEA, Casaccia (Italy). Dipt. Protezione Ambientale e Salute dell'Uomo. Jan 1989. 55p. (In Italian). Order Number DE90724687. Available from NTIS (US Sales Only), PC A04.

With the aim of providing indications for the planning of decommissioning procedures, this paper presents a description of major technical and safety related problems encountered in the qualitative and quantitative radioecological characterization of nuclear plants undergoing decommissioning and decontamination. Reference is

made to several nuclear plant classes (BWRs, PWRs, as well as heavy water, graphite and sodium moderated reactors) activation and contamination processes, direct and indirect radiological analyses and some significant experiences gained by ENEA (Italian Commission for Alternative Energy Sources).

5181 (ENEA-RT-PAS–89-13) **Aerosol measurements, morphological analysis and evaluation of the dynamic shape factor during the TVMA experiment (sodium fires).** Tarroni, G.; Castellani, C.M.; De Zaiacomo, T. Comitato Nazionale per l'Energia Nucleare, Bologna (Italy). Jun 1989. 54p. Order Number DE90724686. Available from NTIS (US Sales Only), PC A04/MF A01.

Within the framework of a European Community program concerning studies on the behaviour of aerosols produced in a sodium fire (Containment Experts Group CONT), a test called TVMA (Test for Validations of codes for Materials behaviour of Aerosols) was designed for the purpose of comparing code calculations with experimental data. The test took place on May 17, 1988 at the CEA CEN-Caradache laboratory. CEA looked after execution of the sodium pool fire and the main parameter measurements. A British (UKAEA) and an Italian (ENEA) team participated in the test with the aim of carrying out measurements on aerosol parameters. The main result (concerning mass aerosol concentration, granulometry and morphological analyses of particles) obtained by the ENEA team, using its own instrumentation, are reported. The dynamic shape factor for particles in the aerodynamic range, 1.9-7 micrometer, as evaluated by measuring geometric particle size after their aerodynamic separation, is also presented.

5182 (EPRI-NP–6559) **Voice communication systems compatible with respiratory protection: Final report.** Donovan, M.D.; Bailey, J.H.; Ayers, R.G. Electric Power Research Inst., Palo Alto, CA (USA); Arinc Research Corp., Annapolis, MD (USA). c Nov 1989. 88p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The needs and benefits of improved voice communication systems for nuclear plant maintenance workers in respiratory protection devices are discussed. The results of a literature survey are presented as are results of on-site interviews to determine voice communication requirements during maintenance task performance and environmental conditions in which communication equipment is used. General technical requirements for a voice communication system compatible with respiratory protection devices are defined. From the results of a survey of communication equipment vendors, it is concluded that radio systems that meet most of these requirements are commercially available but are not in widespread use in the nuclear industry. The experience of current users of these communication systems, as determined during interviews at several nuclear plants, is discussed. Guidelines for the selection, use, and maintenance of voice communication systems are presented. 11 refs., 6 figs., 11 tabs.

5183 (ETDE-IT–89-20) **Size characterization of particles from sodium-water reactions and scrubber efficiency measurements.** Belosi, F.; Ori, C.; Prodi, V.; Caponetti, R.; Cataldi, D.; Petrazzuolo, F.; Montori, I.; Pierdomenico, M.; Pasquale, G. ENEA, Casaccia (Italy). Centro Ricerche Energia. 1988. 10p. (CONF-881009–6: 4. international conference on liquid metal engineering and technology, Avignon (France), 17-21 Oct 1988). Order Number DE90724592. Available from NTIS (US Sales Only), PC A02.

Paper presented at the LIMET 88 4th international congress on liquid metal engineering and technology. Avignone, France. October 17-21 1988.

Sodium removal from the clean up of sodium contamination from plant components at the Research Centre in Casaccia (Rome, Italy) is performed with the use of two different systems: the first one is called prototype wash plant, and the second one a sodium removal plant. The former was realized to remove sodium from large components. According to the component size, the water-sodium reaction occurs in a concrete-walled room (6 x 3.4 x 4 m high) or in a tower, 8.5 m high, 1.7 m wide, and 1.5 m deep. Sodium aerosols developing from the reaction are captured in a scrubber tower filter (Peabody licence). The filter is made of two components: a lower section, where the particles are saturated and an upper section where the particles with increased size are captured by inertia. This report provides a description of the design of these systems (including sketches and flow sheets) and particle sampling procedures. The results of performance tests in which the scrubber efficiency was evaluated by comparing the particle concentrations in the reaction chamber and at the outlet of the chimney, are tabulated and discussed.

5184 (ETDE-IT–89-28) **Obstructions in vertical channels of reactor core flooding systems: Tests with circular sections.** Celata, G.P.; Cumo, M.; Farello, G.E.; Setaro, T. ENEA, Casaccia (Italy). Centro Ricerche Energia. Dec 1987. 49p. (In Italian). Order Number DE90724690. Available from NTIS (US Sales Only), PC A03/MF A01.

The phenomenon of flooding limits the stability of a liquid film moving along the walls of a channel in which there is an upward flow of gas. This destablizing effect can completely block, as noted, the descent of the liquid in its natural downflow. A local reduction in a subchannel of a reactor core, due, for example, to an obstruction, influences the velocity of flooding relative to the gas and the location in which the phenomenon occurs. This report describes a series of results obtained from tests incorporating a circular, plexiglass, test section in which it was possible to introduce orifices of different diameters in such a way as to evaluate the effect of the obstruction on the phenomenon of flooding. A comparison is made between experimental data and estimates based on correlations available in literature, and a method to evaluate the influence of the obstruction is presented.

5185 (IAEA-TECDOC–508) **Survey of ranges of component reliability data for use in probabilistic safety assessment.** International Atomic Energy Agency, Vienna (Austria). Jun 1989. 207p. Order Number DE90610120. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The component reliability data used in the PSA study could greatly influence the final result of the study. Comparison of the data from different sources could therefore yield some interesting insights. As the data have been derived from many sources, on the basis of differing assumptions, the clearest way of comparing data is to plot them on the same graph. This document presents the ranges of rates or probabilities of component failure for selected components that are usually considered in PSA studies. It could also be used to compare particular data with the bulk of data found in the literature. No effort has been made to explain the differences in data. However, some of these differences can be explained by a knowledge of the source of the data. The sources are described in detail in the IAEA Data Base (see IAEA-TECDOC-478), and it is strongly suggested that this document be used together with the IAEA Data Base. This document is intended to be used mainly by people who are knowledgeable in data analysis and the use of data in PSAs. The interpretation of data ranges without regard to the background information and assumptions from the original data source is strongly discouraged. Graphs and tabs.

5186 (IAEA-TECDOC–517) **Application of probabilistic safety assessment to research reactors. Report prepared within the framework of an International Atomic Energy Agency Co-ordinated Research Programme.** International Atomic Energy Agency, Vienna (Austria). Jul 1989. 87p. Order Number DE90610211. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

This document has been prepared to assist in the performance of a research reactor probabilistic safety assessment (PSA). It offers examples of experience gained by a number of Member States in carrying out PSA for research reactors. These examples are illustrative of the types of approach adopted, the problems that arise and the judgements entered into when conducting a PSA. The illustrative examples of experiences gained are discussed in a series of thirteen chapters which address some of the issues that arise in a PSA. The examples are not exhaustive and offer evidence of how other analyses have approached the task of preparing a PSA, for their particular plant. The principles should be capable of being utilised and the various issues which are discussed should be translated into the needs of the analyst. Each PSA will make its own

demands on the analyst depending on the reactor and so the illustrations must only be used as guidance and not adopted as published, without critical appreciation. Refs, figs and tabs.

5187 (INIS-BR–1712) **Probabilistic methods applied to the safety of nuclear power plant: annual report - 1980. Part. 1: theoretical fundaments.** Oliveira, L.F.S. de; Hesles, J.B.S.; Milidiu, R.L.; Maciel, C.C.; Gibelli, S.M.O.; Oliveira, L.C.; Fleming, P.V.; Rivera, R.R.J. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. Feb 1981. 105p. (In Portuguese). Order Number DE90608657. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The probabilistic Safety Analysis Group from COPPE was founded in 1980. This first part of the report shows the theoretical fundaments used for reliability analysis of some safety systems for Angra-1.

5188 (INIS-BR–1733, pp. 69-79) **Environmental effects and nuclear reactor safety.** Rosa, L.P. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1977. (In Portuguese). In *Environmental protection and safety of nuclear facilities.* Order Number DE90608315. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

A study about the environmental effects of nuclear radiation and an analysis about the nuclear power plants accidents are presented. The consequences of those accidents for the population and a safety analysis of Brazilian nuclear installations are presented.

5189 (INIS-BR–1733, pp. 93-127) **Thermal hydraulic analysis of reactor safety.** Silva, D.E. da (Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil)); Lima, J.M. de. Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia. 1977. (In Portuguese). In *Environmental protection and safety of nuclear facilities.* Order Number DE90608315. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

The behaviour of PWR type reactotrs under a loss of coolant accident conditions, as well as the functioning of reactor safety systems are presented.

5190 (INIS-mf–11562, pp. 28) **Iodine monitoring in accident situations.** Janecka, S. (Vyskumny Ustav Jadrovych Elektrarni, Trnava (Czechoslovakia)); Pietrik, I. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. IODINE 131/radiation monitoring; RADIATION ACCIDENTS/iodine 131; RADIATION ACCIDENTS/radiation monitoring; DATA PROCESSING; ENVIRONMENT; ORGANIZING; SAMPLING

5191 (INIS-mf–11562, pp. 38) **Dosimetric aspects of active dismantle of WWR-S reactor.** Krotil, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)); Antol, M.; Neuzil, J.; Chytil, J. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. WWR-S-PRAGUE REACTOR/reactor dismantling; DOSE EQUIVALENTS; PERSONNEL DOSIMETRY; RADIATION PROTECTION

5192 (INIS-mf–11562, pp. 51) **Complete dosimetry of WWR-S reactor vessel and shaft.** Neuzil, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)); Chytil, J.; Uhlir, M. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. REACTOR DISMANTLING/dosimetry; WWR-S-PRAGUE REACTOR/reactor dismantling; DOSIMETRY; TANKS

5193 (INP–1329/B) **Report from the investigation of some radiation consequences of Chernobyl catastrophe in Radiation Protection Measurement Service.** Niewiadomski, T.; Ryba, E. Institute of Nuclear Physics, Cracow (Poland). 1986. 7p. (In Polish). Order Number DE90610862. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Radiation Protection Measurement Service carried out the measurements of the contamination, beta activity of global fallout, dose rate at 1 m above the ground, dose rate in meteorological stations in South Poland and radionuclides concentration in food products in particular, in milk. The measuring methods as well as some results of the measurements are presented. (M.F.W.).

5194 (ITE–1085) **Post Chernobyl studies. Final report MAFF/NERC contract.** Horrill, A.D.; Livens, F.R.; Beresford, N.A. Merlewood Research Station, Grange-over-Sands (UK). Inst. of Terrestrial Ecology. Aug 1987. 12p. Available from British Library Document Supply Centre, Boston Spa, Wetherby. West Yorks. LS23 7BQ.

Data sets in pocket.

Shortly after the Chernobyl accident and subsequent radionuclide deposition in the UK, a number of short and long-term investigations were initiated by the Institute of Terrestrial Ecology. MAFF granted a sum of money, Pound 15,000, for the purposes of 'at the moment' consultation and as a contribution towards those studies. This report fulfils the requirements of the contract as agreed with MAFF with regard to a written report and contains information and data sets on the following projects partially supported by MAFF funding: Great Britain survey, Cumbria survey, time sequence study, Dun Fell transect, sheep tissue analysis. (author).

5195 (NEI-NO–93) **Annual report 1988. Institutt for energiteknikk.** Institutt for Energiteknikk, Kjeller (Norway). 1989. 15p. Order Number DE90610414. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Work at Institutt for energiteknikk (IFE) comprises both nuclear and non-nuclear activities. Nuclear power research at the Institute is performed within the international OECD Halden Reactor Project. The nuclear reactor fuel experiments conducted in 1988 included investigations of the corrosion of fuel cladding materials and measurements of gas pressures inside fuel rods. The effect of fuel pellets roughness on heat transfer to the fuel cladding, and the use of different filler gases in the fuel rods were also studied. Work continiued on the development of a new thermometer to measure fuel temperatures and on other instruments. The second major research function of the Halden Project involves the development of computerized reactor process controls. This represents over one-third of the total research programme and emphasizes analysis of human performance and computer-based control and monitoring of the operational aspects of nuclear power plants. This work has resulted in the development of a monitoring system to help operators diagnose and mitigate the consequences of an accident. In addition, the SCORPIO Core Surveillance System, which was developed in Halden, was installed in the control room of a Swedish reactor at Ringhals in 1988.

5196 (NUREG–0823-Suppl.1) **Integrated plant safety assessment, Systematic Evaluation Program: Dresden Nuclear Power Station, Unit 2 (Docket No. 50-237): Final report.** Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear

Reactor Regulation. Oct 1989. 57p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A04/MF A01 - GPO; OSTI; INIS.

The US Nuclear Regulatory Commission (NRC) has prepared Supplement 1 to the final Integrated Plant Safety Assessment Report (IPSAR) (NUREG-0823), under the scope of the Systematic Evaluation Program (SEP), for the Commonwealth Edison Company (CECo) Dresden Nuclear Power Station, Unit 2 located in Grundy County, Illinois. The NRC initiated the SEP to provide the framework for reviewing the design of older operating nuclear reactor plants to reconfirm and document their safety. This report documents the review completed by means of the SEP for those issues that required refined engineering evaluations or the continuation of ongoing evaluations subsequent to issuing the final IPSAR for Dresden Unit 2. The review was provided for (1) an assessment of the significance of differences between current technical positions on selected issues and those that existed when Dresden Unit 2 was licensed, (2) a basis for deciding on how these differences should be resolved in an integrated plant review, and (3) a documented evaluation of plant safety. The final IPSAR and this supplement forms part of the bases for considering the conversion of the existing provisional operating license to a full-term operating license. 83 refs., 9 tabs.

5197 (NUREG/CR–2000-Vol.8-No.9) **Licensee Event Report (LER) compilation for month of September 1989: Volume 8, No. 9.** Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data; Oak Ridge National Lab., TN (USA). Oct 1989. 128p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. (ORNL/NSIC–200-Vol.8-No.9). Available from NTIS, PC A07/MF A01 - GPO; OSTI; INIS.

This monthly report contains License Event Report (LER) operational information that was processed into the LER data file of the Nuclear Safety Information Center (NSIC) during the one month period identified on the cover of the document. The LERs, from which this information is derived, are submitted to the Nuclear Regulatory Commission (NRC) by nuclear power plant licensees in accordance with federal regulations. Procedures for LER reporting for revisions to those events occurring prior to 1984 are described in NRC Regulatory Guide 1.16 and NUREG-0161, Instructions for Preparation of Data Entry Sheets for Licensee Event Reports. For those events occurring on and after January 1, 1984, LERs are being submitted in accordance with the revised rule contained in Title 10 Part 50.73 of the Code of Federal Regulations (10 CFR 50.73 – Licensee Event Report System) which was published in the Federal Register (Vol. 48, No. 144) on July 26, 1983. NUREG-1022, Licensee Event Report System – Description of Systems and Guidelines for Reporting, provides supporting guidance and information on the revised LER rule.

5198 (NUREG/CR–4639-Vol.4-Pt.1-Rev.1) **Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR): User's guide: Part 1, Overview of NUCLARR data retrieval.** Gilmore, W.E. (); Gentillon, C.D.; Gertman, D.I.; Beers, G.H.; Galyean, W.J.; Gilbert, B.G.; Reece, W.J. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; EG and G Idaho, Inc., Idaho Falls, ID (USA). Sep 1989. 27p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC07-76ID01570. (EGG–2458-Vol.4-Pt.1-Rev.1). Available from NTIS, PC A03/MF A01 - GPO - OSTI.

The Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR) is an automated data base management system for processing and storing human error probability and hardware component failure data. The NUCLARR system software resides on an IBM (or compatible) personal microcomputer. NUCLARR can be used by the end user to furnish data inputs for both human and hardware reliability analysis in support of a variety of risk assessment activities. 11 refs.

5199 (NUREG/CR–4639-Vol.4-Pt.2-Rev.1) **Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR): User's guide: Part 2, Guide to operations.** Gilmore, W.E.; Gentillon, C.D.; Gertman, D.I.; Beers, G.H.; Galyean, W.J.; Gilbert, B.G.; Reece, W.J. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; EG and G Idaho, Inc., Idaho Falls, ID (USA). Oct 1989. 135p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC07-76ID01570. (EGG–2458-Vol.4-Pt.2-Rev.1). Available from NTIS, PC A07/MF A01 - GPO - OSTI.

The Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR) is an automated data base management system for processing and storing human error probability and hardware component failure data. The NUCLARR system software resides on an IBM (or compatible) personal microcomputer. NUCLARR can be used by the end user to furnish data inputs for both human and hardware reliability analysis in support of a variety of risk assessment. 4 refs., 60 figs., 7 tabs.

5200 (NUREG/CR–4639-Vol.4-Pt.3-Rev.1) **Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR): User's guide: Part 3, NUCLARR system description, Revision 1.** Gilmore, W.E. (EG and G Idaho, Inc., Idaho Falls, ID (USA)); Gentillon, C.D.; Gertman, D.I.; Beers, G.H.; Galyean, W.J.; Gilbert, B.G.; Reece, W.J. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; EG and G Idaho, Inc., Idaho Falls, ID (USA). Oct 1989. 236p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC07-76ID01570. (EGG–2458-Vol.4-Pt.3-Rev.1). Available from NTIS, PC A11/MF A01 - GPO - OSTI.

The Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR) is an automated data base management system for processing and storing human error probability and hardware component failure data. The NUCLARR system software resides on an IBM (or compatible) personal microcomputer. NUCLARR can be used by the end user to furnish data inputs for both human and hardware reliability analysis in support of a variety of risk assessment activities. 10 refs., 12 figs., 15 tabs.

5201 (NUREG/CR–5323) **Validation of risk-based performance indicators: Safety system function trends.** Boccio, J.L. (Brookhaven National Lab., Upton, NY (USA)); Vesely, W.E.; Azarm, M.A.; Carbonaro, J.F.; Usher, J.L.; Oden, N. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research; Brookhaven National Lab., Upton, NY (USA); Science Applications International Corp., Columbus, OH (USA). Oct 1989. 147p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC02-76CH00016. (BNL-NUREG–52186). Available from NTIS, PC A07/MF A01 - GPO; OSTI; INIS.

This report describes and applies a process for validating a model for a risk-based performance indicator. The purpose of the risk-based indicator evaluated, Safety System Function Trend (SSFT), is to monitor the unavailability of selected safety systems. Interim validation of this indicator is based on three aspects: a theoretical basis, an empirical basis relying on statistical correlations, and case studies employing 25 plant years of historical data collected from five plants for a number of safety systems. Results using the SSFT model are encouraging. Application of the model through case studies dealing with the performance of important safety systems shows that statistically significant trends in, and levels of, system performance can be discerned which thereby can provide leading indications of degrading and/or improving performances. Methods for developing system performance tolerance bounds are discussed and applied to aid in the interpretation of the trends in this risk-based indicator. Some additional characteristics of the SSFT indicator, learned through the data-collection efforts and subsequent data analyses performed, are also discussed. The usefulness and practicality of other data sources for validation purposes are explored. Further validation of this indicator is noted. Also, additional research is underway in developing a more detailed estimator of system unavailability. 9 refs., 18 figs., 5 tabs.

5202 (NUREG/CR–5341) **Round-robin analysis of the behavior of a 1:6-scale reinforced concrete containment model pressurized to failure: Posttest evaluations.** Clauss, D.B. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Sandia National Labs., Albuquerque, NM (USA). Oct 1989. 456p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC04-76DP00789. (SAND–89-0349). Available from NTIS, PC A20/MF A01 - GPO; OSTI; INIS.

A 1:6-scale model of a reinforced concrete containment building was pressurized incrementally to failure at a remote site at Sandia National Laboratories. The response of the model was recorded with more than 1000 channels of data (primarily strain and displacement measurements) at 37 discrete pressure levels. The primary

objective of this test was to generate data that could be used to validate methods for predicting the performance of containment buildings subject to loads beyond their design basis. Extensive analyses were conducted before the test to predict the behavior of the model. Ten organizations in Europe and the US conducted independent analyses of the model and contributed to a report on the pretest predictions. Predictions included structural response at certain predetermined locations in the model as well as capacity and failure mode. This report discusses comparisons between the pretest predictions and the experimental results. Posttest evaluations that were conducted to provide additional insight into the model behavior are also described. The significance of the analysis and testing of the 1:6-scale model to performance evaluations of actual containments subject to beyond design basis loads is also discussed. 70 refs., 428 figs., 24 tabs.

5203 (NUREG/CR–5406-Vol.1) **BWR reactor water cleanup system flexible wedge gate isolation valve qualification and high energy flow interruption test: Analysis and conclusions: Volume 1.** DeWall, K.G.; Steel, R. Jr. EG and G Idaho, Inc., Idaho Falls, ID (USA). Oct 1989. 43p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC07-76ID01570. (EGG–2569-Vol.1). Available from NTIS, PC A03/MF A01 - GPO; OSTI; INIS.

This report presents the measured data and the analyses performed to date on the full-scale high-energy qualification and flow interruption gate valve testing to develop technical insights for the United States Nuclear Regulatory Commission (USNRC) effort regarding Generic Issue 87 (GI-87). The research was sponsored by the USNRC and conducted by researchers from the Idaho National Engineering Laboratory. We tested two 6-in., 900-lb class valve assemblies, which represent a significant percentage of the reactor water cleanup isolation valves installed in plant applications. These valves were modified before testing by adding a high temperature load cell in the valve stems, which allowed the direct measurement of valve stem thrust during both opening and closing valve cycles. Instrumentation installed in the flow loop and on the valve assemblies measured the important valve system test responses. Additionally, during the test program, all of the currently popular motor operated valve diagnostic test systems monitored the performance of the valves. Initially the valves were subjected to the hydraulic and leakage qualification tests defined in ANSI B 16.41 and then to flow interruption and reopening valve tests at boiling water reactor primary system water temperature and pressure conditions with downstream line break flows. For the two valves tested, results show that (a) the disc factor used in current industry motor operator sizing equations may require an additional term to account for nonlinear performance, (b) the thrusts required to close the valves were sensitive to the fluid temperature, and (c) the results of testing at lower pressures, temperatures, and flows cannot be extrapolated to design basis pressures, temperatures, and flows for valve designs that have not exhibited linear performance behavior during design basis prototypical testing. 2 refs., 30 figs., 4 tabs.

5204 (NUREG/CR–5406-Vol.3) **BWR reactor water cleanup system flexible wedge gate isolation valve qualification and high energy flow interruption test: Review of issues associated with BWR containment isolation valve closure: Volume 3.** DeWall, K.G. (EG and G Idaho, Inc., Idaho Falls, ID (USA)); Steele, R. Jr. Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research; EG and G Idaho, Inc., Idaho Falls, ID (USA). Oct 1989. 44p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC07-76ID01570. (EGG–2569-Vol.3). Available from NTIS, PC A03/MF A01 - GPO; OSTI; INIS.

This report presents the results of research performed to develop technical insights for the NRC effort regarding Generic Issue 87, "Failure of HPCI Steam Line Without Isolation." Volume III of this report contains the data and findings from the original research performed to assess the qualification of the valves and reported in EGG-SSRE-7387, "Qualification of Valve Assemblies in High Energy BWR Systems Penetrating Containment." We present the original work here to complete the documentation trail. The recommendations contained in Volume III of this report resulted in the test program described in Volume I and II. The research began with a survey to characterize the population of normally open containment isolation valves in those process lines that connect to the primary system and penetrate containment. The qualification methodology used by the various manufacturers identified in the survey is reviewed and deficiencies in that methodology are identified. Recommendations for expanding the qualification of valve assemblies for high energy pipe break conditions are presented. 11 refs., 1 fig., 2 tabs.

5205 (NUREG/CR–5420) **Multiple system responses program: Identification of concerns related to a number of specific regulatory issues.** Murphy, G.A. (Oak Ridge National Lab., TN (USA)); Casada, M.L.; Palko, L.E.; Roberts, M.W. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Issue Resolution; Oak Ridge National Lab., TN (USA); JBF Associates, Knoxville, TN (USA). Oct 1989. 99p. Sponsored by Nuclear Regulatory Commission. DOE Contract AC05-84OR21400. (ORNL/NOAC–234). Available from NTIS, PC A06/MF A01 - GPO; OSTI; INIS.

This document describes the activities and results of the Multiple System Responses (MSR) program conducted by the Nuclear Operations Analysis Center (NOAC) at Oak Ridge National Laboratory (ORNL). The objective of the MSR program was to gather and review documentation for several unresolved safety issues and related programs of interest, and from that documentation, describe any additional potential safety concerns. The MSR program provides information that will aid the NRC staff in making an assessment of the relative safety significance of the concerns through the established prioritization process. Judgments were not made regarding the validity of the concerns expressed by others. Rather, the concerns were documented and potential safety issues were developed and defined as specifically as possible. Twenty-one potential safety issues were developed from the documented concerns. Additional information was gathered to support the NRC efforts in reviewing these issues for prioritization. 73 refs., 2 tabs.

5206 (NUREG/CR–5470) **Component fragility research program: Phase 2, Development of seismic fragilities from high-level qualification data.** Tsai, N.C. (NCT Engineering, Inc., Lafayette, CA (USA)); Mochizuki, G.L.; Holman, G.S. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; NCT Engineering, Inc., Lafayette, CA (USA); Lawrence Livermore National Lab., CA (USA). Nov 1989. 129p. Sponsored by Nuclear Regulatory Commission. DOE Contract W-7405-ENG-48. (UCID–21820). Available from NTIS, PC A07/MF A01 - GPO; OSTI; INIS.

To demonstrate how "high-level" qualification test data can be used to estimate the ultimate seismic capacity of nuclear power plant equipment, we assessed in detail various electrical components tested by the Pacific Gas & Electric Company for its Diablo Canyon plant. As part of our Phase I Component Fragility Research Program, we evaluated seismic fragility for five Diablo Canyon components: medium-voltage (4kV) switchgear; safeguard relay board; emergency light battery pack; potential transformer; and station battery and racks. This report discusses our Phase II fragility evaluation of a single Westinghouse Type W motor control center column, a fan cooler motor controller, and three local starters at the Diablo Canyon nuclear power plant. These components were seismically qualified by means of biaxial random motion tests on a shaker table, and the test response spectra formed the basis for the estimate of the seismic capacity of the components. The seismic capacity of each component is referenced to the zero period acceleration (ZPA) and, in our Phase II study only, to the average spectral acceleration (ASA) of the motion at its base. For the motor control center, the seismic capacity was compared to the capacity of a Westinghouse Five-Star MCC subjected to actual fragility tests by LLNL during the Phase I Component Fragility Research Program, and to generic capacities developed by the Brookhaven National Laboratory for motor control center. Except for the medium-voltage switchgear, all of the components considered in both our Phase I and Phase II evaluations were qualified in their standard commercial configurations or with only relatively minor modifications such as top bracing of cabinets. 8 refs., 67 figs., 7 tabs.

5207 (RTR–2661) **Lead expansion anchor load capacity in reactor buildings at the Savannah River Site.** Bryant, E.L. Westinghouse Savannah River Co., Aiken, SC (USA). 15 Aug 1989. 23p.

Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. Order Number DE90000597. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Walkdowns to determine the seismic adequacy of selected safety systems have been performed for L and K reactors utilizing the Unresolved Safety Issue (USI) A-46 methodology sponsored by the Seismic Qualification Utility Group (SQUG). Actual experience data from earthquakes, test data compiled by the Electric Power Research Institute (EPRI), and other data for certain classes of nuclear plant equipment make up the SQUG data base. Anchorage is also addressed in the USI A-46 methodology. However, lead expansion anchors are not included. Some safety related equipment in the Savannah River Site (SRS) reactor buildings is supported by lead expansion anchors. Design load capacity was based on the allowable loads listed in SRS Standard B8M which was intended to provide a factor of safety of 4. However, walkdowns have revealed that some lead anchors are not installed per B8M, and therefore the actual load capacity of these anchors may be less than indicated in the B8M. A testing program (SP-2449) was developed and 107 abandoned anchors in K, L, P and R reactor buildings were tested to determine shear and tension load capacities. 14 figs., 2 tabs.

5208 (UJV–8701-T) **Safety analyses of the LVR-15 reactor (mathematical model).** Macek, J.; Malacka, M. Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia). Mar 1989. 35p. (In Czech). Order Number DE90608781. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A mathematical model is described of the LVR-15 experimental reactor core and primary circuit. Described are the thermal hydraulics of main primary circuit components, a model of point kinetics for reactor output calculations, and equations for residual heat. An approach to numerical solution is presented and computer programs briefly described. (author). 6 figs., 4 tabs., 28 refs.

5209 **Fluid-structure vibration and liquid sloshing.** PVP - Vol. 128. Ma, D.C.; Su, T.C. 110p. American Society of Mechanical Engineers, New York, NY (1987). (CONF-870636–: 5. national congress on pressure vessels and piping, San Diego, CA (USA), 28 Jun - 2 jul 1987).

This book contains 12 selections. Some of the titles are: A dynamic analysis of LMFBR core by a homogenization method; Evaluation of fluid effects on the dynamic response of a fast reactor core; Fluid structure interaction by means of MBE technique; Effects of fluid pressures on the vibration characteristics of cylindrical vessels; and a study on fluid-structure interaction of a pool-type LMFBR reactor vessel.

5210 **Neutron spectrum adjustment with SANDII using arbitrary trial functions.** Kelly, J.G. (Sandia National Labs., Albuquerque, NM (USA)). pp. 798 of Reactor dosimetry: Methods, applications, and standardization. Farrar IV, H.; Lippincott, E.P. ASTM, Philadelphia, PA (1989). DOE Contract AC04-76DP00789. (CONF-870501–: 6. ASTM-Euratom symposium on reactor dosimetry: methods, applications, and standardization, Jackson Hole, WY (USA), 31 May - 5 jun 1987).

A procedure has been developed to use the SANDII spectrum adjustment code to generate satisfactory neutron spectra in a manner that does not require initial trial functions that approximate the real spectra. Thus a spectrum can be determined primarily by a set of foil activation data, and a priori calculations of a trial spectrum or detailed knowledge about the experiment environment are not required. The reduction in the amount of information required facilitates interlaboratory comparisons and the efficiency of the spectrum generation process. Examples are provided, and a discussion is included that considers conditions under which the procedure can be expected to yield acceptable results.

5211 **The TITAN reversed-field pinch reactor: Design-point determination and parametric studies.** . Miller, R.L. (TITAN Research Group, Los Alamos National Lab., Los Alamos, NM (USA)). vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The multi-institutional TITAN study has examined the physics, technology, safety, and economics issues associated with the operation of a Reversed-Field Pinch (RFP) magnetic fusion reactor at high power density. A comprehensive system and trade study has been conducted as an integral and ongoing part of the reactor assessment. Attractive design points emerging from these parametric studies are subjected to more detailed analysis and design integration, the results of which are used to refine the parametric systems model. The design points and tradeoffs for two TITAN/RFP reactor embodiments are discussed.

24 POWER TRANSMISSION AND DISTRIBUTION

Refer also to citation(s) 5791

5212 (CRIE-T–88040) **Study on factors in increase of breakdown strength of gas mixed with liquid mist.** Yashima, Masafumi; Fujinami, Hideo; Takuma, Toru. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Mar 1989. 36p. (In Japanese). Order Number DE90725001. Available from NTIS (US Sales Only), PC A03/MF A01.

It has been suggested that the breakdown strength of gaseous dielectrics may gently increase by mixing liquid mist such as carbon-halide mist. In the previous paper, the authors investigated the breakdown characteristics of gaseous dielectrics of N_2 and SF_6 mixed with C_2Cl_4 mist, and supposed the scarcity of initial electrons as the predominant factor in the increase of the breakdown strength. In this report, the authors experimentally verified this point, and investigated the mechanism of the scarcity of initial electrons. Based on the results, the conditions under which the breakdown strength increases are clarified about an applied voltage wave form or gas pressure, and actual applied fields of dielectrics are arranged and proposed. They concluded that the application of the dielectrics to actual gas insulated equipments has little merit in improving the breakdown characteristics, except for a few special purposes. 27 refs., 11 figs., 3 tabs.

2402 Power System Networks, Transmission and Distribution

Refer also to citation(s) 5370

5213 (CEA/RD–CE-02788) **[Canadian Electrical Association] Research implementation.** Canadian Electrical Association, Montreal, PQ (Canada). Jan 1986. 60p. (CE–02788). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST FUNDS CAN.

This report presents 30 selected examples of Canadian Electrical Association (CEA) research and development (R&D) project results that have been beneficially applied by electric utilities in Canada in order to increase energy efficiency or to decrease pollution. These examples cover the four sections of R&D undertaken by the CEA, namely: generation, transmission systems, distribution, and utilization. This publication demonstrates that the CEA R&D program has had and continues to have a high rate of success. Many of these projects have saved Canadian utilities significant amounts of money. By the same token, safety, as it relates to the operation and maintenance of electrical systems, has far reaching implications to utilities. It is hoped that the document will be updated periodically as more projects are completed and their benefits assessed. 30 figs.

5214 (EPRI-EL–6555) **Probability methods applied to electric power systems: Proceedings.** Electric Power Research Inst., Palo Alto, CA (USA). c Nov 1989. 556p. Sponsored by Electric Power Research Institute. (CONF-8809416–: 2. international symposium on probability methods applied to electric power systems, Oakland, CA (USA), 20-23 Sep 1988). Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The roots of understanding probabilistic phenomena go back to antiquity. We have been willing to bet our money on the roll of dice

or similar events for centuries. Yet, when it comes to betting our lives or livelihood, we have been slow to adapt probabilistic methods to describe uncertainty. As a matter of fact, we are loath to admit a probability of failure when it comes to such structures as bridges, buildings or airplanes. Electric utility engineers the world over realize that reliability of structures and systems can be improved and money can be saved if we use a more enlightened approach to uncertainty. The technology and analytical power that is now being made available to the working engineer make that possible. It is for this reason, the International Council on Probability Methods Applied to Power Systems (PMAPS) was formed in 1985. It is important that engineers have a forum for exchange of knowledge and ideas on subjects related to describing and coping with uncertainty. As the world becomes more complex and demands increase, it is the engineers lot to make the most efficient use possible of scarce resources. The papers contained within this document cover the design and analysis of transmission components, systems analysis and reliability assessment, testing of power components, systems operations planning and probabilistic analysis, power distribution systems, cost, and mathematical modeling. The individual papers have been individually cataloged and indexed.

5215 (IREQ–174T703) **Artificially commutated HVDC inverters.** Sood, V.K. Institut de Recherche d'Hydro-Quebec, Varennes, PQ (Canada). Apr 1989. vp. (CE–02428). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRIES UPON REQUEST CAN.

Line commutated thyristor inverters are now firmly established in bulk power high voltage, direct current (HVDC) transmission schemes. The benefits of schemes employing HVDC are well known, but operational problems for such schemes become apparent when an adequate commutation voltage is transiently unavailable, either in terms of magnitude and/or angular displacement. Such operational probems are normally experienced when an inverter feeds into weak AC system. As such ties to weak AC systems become more common and increasingly necessary, artificial (or forced) commutation is being considered as a possible solution to these problems. Earliest references to artificially commutated inverters date back to the 1920s. However, mainly because of economic and technical restrictions due to the use of circuit-commutated thyristors, no practical application of an artificially commutated converter (ACC) in the transmission of bulk power was implemented. With potential benefits and more secure commutation available from the use of new, faster self-commutating devices (such as MOSFET Transistors, Gate-Turn-Off and Static Induction Thyristors), prospects for ACCs now appear promising. It is the objective of this document to review the state of the art for this topic of artificially commutated HVDC converters (ACCs), and recommend to the Canadian Electrical Association Transmission and Distribution R & D sub-committee specific area of research to follow. It is not, however, the objective of this document to provide a voluminous thesis on the topic. 79 refs., 30 figs., 3 tabs.

2403 Power Transmission Lines and Cables

5216 (CRIE-T–11) **Protection of outages caused by winter lightning on overhead transmission lines.** Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Mar 1989. 76p. (In Japanese). Order Number DE90725014. Available from NTIS (US Sales Only), PC A05/MF A01.

This paper summarized the results of studies, such as experiments, observations and simulations, carried out by the Central Research Institute of Electric Power Industry to understand the cause of outages of overhead transmission lines by winter lightning and to develop the technique of protection of outages. From 1966 to 1982, outages of transmission lines were investigated to know the characteristics of outages by winter lightning. From the results of the observations of winter lightning during 9 years since 1978, the behavior of winter lightning has been clarified. Some processes about the outages caused by lightning on transmission lines were analyzed by model tests and simulations. The causes of the outages of lines by winter lightning were discussed and the protection methods were proposed. Further, the relation between outages of lines and limit of transmission capacity was investigated, and it was clarified that the protection of outages largely contributes to increase transmission volume. The direction of the researches in future was suggested with its validity and importance. 35 refs., 49 figs., 8 tabs.

5217 (IREQ–046D549) **Characterization of secondary arcing faults: Part 1: General characteristics.** Koch, B. Institut de Recherche d'Hydro-Quebec, Varennes, PQ (Canada). Jun 1989. 130p. (CE–02789). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

The aim of this report is to establish the minimum value and characteristics of a non-self-extinguishing arcing ground fault current on 347/600 V solidly grounded systems, and also to establish the basic characteristics of the electric arc at this voltage level, namely the arc voltage, arc resistance and multiplication factor. A large volume of tests and investigations at prospective currents of 1 to 16 kA led to the conclusion that an arcing fault at 347 V driving voltage should always be considered non-self-extinguishing, even in the case of electrode gaps of over 25mm. Several mathematical fault-arc simulation methods have been developed and successfully tested. 29 refs, 48 figs., 32 tabs.

5218 (IREQ–217D503) **Study of nuisance fuse operation on MV [medium voltage] power lines during electrical storms.** Hamel, A.; St-Jean, G. Institut de Recherche d'Hydro-Quebec, Varennes, PQ (Canada). Jun 1989. 87p. (CE–02790). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

The project consisted of reproducing in a laboratory a sequence of events simulating the natural conditions that cause some nuisance operation of fuses on real distribution transformers during storms. It was observed that such nuisance operations can be caused by a long, (a few milliseconds) low-amplitude (a few hundred amperes) lightning current passing through a surge arrester, causing saturation of its protected transformer, and an inrush-current that blows the fuse without a fault situation. A sensitivity analysis was performed by varying the three items of equipment involved: surge arrester, transformer and fuse, in order to identify critical and noncritical situations. It was observed that more care must be exercised when selecting the type and rating of both the arrester and the fuse. Modifying transformers is too costly to even contemplate. It was observed that fuses of high current rating do not represent a problem since they will never operate in such conditions. 47 refs., 30 figs., 6 tabs.

5219 (SESL–249D541) **Simplified rules for grounding customer-owned high voltage substations.** Dawalibi, F.; Southey, R.D. Safe Engineering Services Ltd., Montreal, PQ (Canada). Jun 1989. vp. (CE–02791). Available from Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN.

The objectives of the research project described in this report were the following: to establish clear and appropriate Canadian Electrical Code Rules and Appendix B Notes for the grounding of customer-owned high voltage substations; and to provide a more practical method to calculate ground potential rise and step and touch potentials than currently available. The 5 major tasks performed during this research project were: a computerized literature search; a survey of utility engineers and chief electrical inspectors on the subject of distribution grounding; a computerized sensitivity analysis of various grounding situations in uniform and two-layer soil types, along with a safety analysis; the development of a user-friendly computer program, AUTOGRID, for the analysis and design of distribution substation grounding systems; and, finally, modifications to many existing Canadian Electrical Code Guidelines, along with proposals for several new ones. The most important proposed rule modifications bear on the following subjects designs base on grid injection currents; a revised Table 52 which incorporates guidelines on electrical shock safety criteria; soil resistivity measurements; a clarification of grounding loop requirements; grid designs including

concrete reinforcement steel; preapproved grid designs; and expanded Appendix B notes to improve understanding of the factors which make a grounding system sound. 79 refs., 91 figs., 20 tabs

2407 Economic, Industrial, and Business Aspects

Refer also to citation(s) 5327

25 ENERGY STORAGE

Refer also to citation(s) 5403

2506 Thermal

5220 (AD-A-211404/9/XAB) **Phase-change material for spacecraft thermal management. Interim report, 15 March 1987-31 March 1988.** Sheffield, J.W.; Wen, C. Missouri Univ., Rolla, MO (USA). Dept. of Mechanical and Aerospace Engineering. Apr 1989. 72p. Available from NTIS, PC A04/MF A01.

See also rept. dated Feb 89, AD-B134 726.

Heat-transfer problems involving phase change are encountered extensively in technical and natural processes. Latent heat storage, which possess the advantages of high density of energy and isothermal behavior during charging and discharging, is one application of using phase-change material (PCM). A computational model is presented for the prediction of the heat transfer between a heat-transfer fluid (HTF) and PCM of latent heat storage unit. Two models of flow, hydrodynamically fully developed flow and developing flow, of the HTF were proposed in this study. A two-dimensional enthalpy method was used for the computation of the phase-change heat transfer in the PCM. A fully implicit finite-difference scheme was used for the calculation of convective heat transfer in the HTF. The unknown time dependent boundary condition between the HTF and the PCM was found iteratively. The predictions are substantiated by their fair agreement with experimental data. Factors that affect the heat transfer rates between the HTF and the PCM were studied numerically for both hydrodynamically fully developed flow and developing flow. It is found that the Nusselt number is significantly increased by the developing temperature profiles.

5221 (CONF-891208-17) **Satellite thermal storage systems using metallic phase-change materials.** Lauf, R.J.; Hamby, C. Oak Ridge National Lab., TN (USA). [1989]. 5p. Sponsored by National Aeronautics and Space Administration. DOE Contract AC05-84OR21400. From Winter annual meeting of the American Society of Mechanical Engineers; San Francisco, CA (USA); 10-15 Dec 1989. Order Number DE89016872. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Solar (thermal) dynamic power systems for satellites require a heat storage system capable of operating the engine during eclipse. This paper describes a system in which the phase-change material (PCM) is a metal rather than the more conventional fluoride salts. Thermal storage modules consisting of germanium contained in graphite have good thermal conductivity, low parasitic mass, and are physically and chemically stable. We describe the result of thermal cycle testing of graphite capsules containing germanium and several germanium- and silicon-based alloys, as well as some initial tests of the compatibility of graphite with Nb-1%Zr structural materials. 7 refs., 7 figs., 3 tabs.

5222 (PNL-7139) **Aquifer characterization at the Veterans Administration Hospital, Tuscaloosa, Alabama.** Cronin, W.E.; Luttrell, S.P.; Hall, S.H. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 21p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. Order Number DE90004437. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Veterans Administration (VA) is studying the feasibility of aquifer thermal storage (ATES) at their Tuscaloosa, Alabama, facility. To determine the characteristics of the aquifer underlying the facility, the Pacific Northwest Laboratory gathered information about the environment of the aquifer and conducted tests to estimate the aquifer's transmissivity, ground-water flow direction, and velocity. Seven wells were drilled at the VA site. It was found that ground-water flow direction at the site is generally toward the southwest. The magnitude of the gradient is approximately 2.5×10^{-3} to 3×10^{-3} ft/ft. For six of the seven wells, clay lenses or thick clay layers appear to be acting locally as confining or semi-confining layers. Three types of test were conducted at the site: a step drawdown test, a constant discharge and recover test, and a single-well tracer test. The data yielded responses suggesting leaky confined or delayed yield models for the aquifer. Drawdown and recovery versus time were matched type curves for delayed yield to obtain estimates of transmissivity and storage. This recovery method gave the best fit to the drawdown-versus-time curves. Using this method it was found that transmissivity ranged from 500 to 9000 ft^2/day and storage ranged from 1.5×10^{-4} to 4.5×10^{-2} for the wells tested. Using the results of the pump and tracer tests simultaneously, ground-water velocity was estimated to be approximately 0.8 ft/day, with an effective porosity of approximately 12%. 4 refs., 7 figs., 3 tabs.

5223 (PNL-7141) **Aquifer characterization at the General Motors Harrison Division Plant, Tuscaloosa, Alabama.** Luttrell, S.P.; Cronin, W.E.; Hall, S.H. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 27p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. Order Number DE90004436. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The General Motors corporation is studying the feasibility of aquifer thermal energy storage (ATES) for cooling purposes at its Harrison Division plant Tuscaloosa, Alabama. To determine the characteristics of the aquifer underlying the plant, the Pacific Northwest Laboratory (PNL) gathered information about the environment of the aquifer and conducted tests to determine the aquifer's transmissivity and flow. From these tests, calculated estimates of ground-water velocity and flow direction were made. Nine wells were drilled at the plant site. Apparently, a confining bed of clay locally divides the aquifer into two separate units, one confined and one unconfined. An initial attempt to determine the hydraulic gradient in the aquifer was complicated by the resulting discrepancies in water levels among wells as well as by offsite pumping of the same aquifer; however, an estimate of the direction and magnitude of the hydraulic gradient for the composite aquifer was made. Two other types of tests successfully provided data for ground-water flow velocity for ATES design. A constant-discharge and recovery test was conducted to determine transmissivity (hydraulic conductivity). A single-well tracer test was also conducted, and results of the two tests were used conjunctively to estimate ground-water flow velocity. Transmissivity was found to be approximately 2000 ft^2/day at two wells closet to the pumped well in the parking lot of the General Motors plant. The average hydraulic conductivity is assumed to be approximately 40 ft/day in the same vicinity. The calculated ground-water velocity is approximately 3.25 ft/day with an effective porosity of approximately 6%. 5 refs., 7 figs., 3 tabs.

2509 Batteries

Refer also to citation(s) 5290, 5292, 5293

5224 (AD-A-211674/7/XAB) **Fast heterogeneous electron-transfer rates for glassy carbon electrodes without polishing or activation procedures.** Rice, R.; Alfred, C.; McCreery, R. Ohio State Univ., Columbus, OH (USA). Dept. of Chemistry. 1989. 8p. Available from NTIS, PC A02/MF A01.

Pub. in Jnl. Electroanalytical Chemistry, Vol. 263, 163-169(1989).

Glassy carbon (CG) is an attractive choice for an electrode material because it has a wide potential range, is inexpensive, readily available, and chemically inert in most electrolytes. The typical preparation of a GC electrode includes the removal of gross surface features by abrasion with silicon carbide paper and subsequent polishing with alumina. The electrochemistry of many redox systems such as ascorbic acid (AA), ferri/ferrocyanide, and dopamine on GC are very sensitive to the polishing procedure, with variations in the heterogeneous electron transfer rate constant K(o), for the $Fe(CN)_6$ (3-/4-) redox system covering at least three orders of magnitude. This variation has been attributed primarily to superficial impurities and polishing debris.

5225 (CONF-891132–9) **Li-Al/FeS_2 research at ANL [Argonne National Laboratory].** Kaun, T.D.; Duoba, M.J.; Gillie, K.R. Argonne National Lab., IL (USA). 1989. 35p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From 9. battery and electrochemical contractors' conference; Alexandria, VA (USA); 13-17 Nov 1989. Order Number DE90003573. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Research is being conducted to bring a high-performance secondary battery containing Li-Al/FeS_2 cells with molten-salt electrolyte closer to commercial development. To maintain the electrolyte in the molten state, cells are normally operated at temperatures of 375-425°C. The objective of this research is the development of lithium-alloys/FeS_2 cells that will attain high performance (~200 Wh/kg and 400 W/kg) and long cycle life (>1000 cycles) and will have the potential for low-cost fabrication. Recent efforts have been concentrated on developing an electrolyte-starved (ES) cell design that is both overdischarge and overcharge tolerant (OCT). Also under investigation is a bipolar configuration that will substantially increase battery performance. 34 figs., 1 tab.

5226 (CONF-8907170–1) **Life evaluation of valve-regulated lead-acid batteries for load-leveling applications.** DeLuca, W.H.; Miller, J.F.; Webster, C.E.; Hogrefe, R.L. Argonne National Lab., IL (USA). [1989]. 17p. Sponsored by Electric Power Research Institute; International Lead Zinc Research Organization (ILZRO). DOE Contract W-31109-ENG-38. From 2. international conference on batteries for utility energy storage; Newport Beach, CA (USA); 24-28 Jul 1989. Order Number DE90002188. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Argonne National Laboratory (ANL) has initiated a test program to evaluate the suitability of valve-regulated lead-acid (VRLA) batteries for use in deep-discharge cycling applications. The program includes the examination of VRLA batteries of the gelled-electrolyte design and the absorbed-electrolyte type. This work is sponsored by the Electric Power Research Institute (EPRI) and the International Lead Zinc Research Organization (ILZRO). While VRLA batteries have found use in standby and uninterruptable power source applications, insufficient data available to determine their performance and life in repetitive cycling applications. The objectives of the ANL test plan are (1) to use accelerated testing techniques to obtain evidence within a 6 month test period that indicate an expected life in a utility operating environment, (2) to determine VRLA battery life within a 2-3 year time period under conditions (temperature and depth-of-discharge) that closely simulate those encountered in load-leveling operations, and (3) to assess the applicability and usefulness of accelerated testing procedures for deep-discharge cycling applications. 4 figs., 4 tabs.

5227 (CONF-8910107–4) **Rechargable molten-electrolyte lithium batteries: A status report.** Kaun, T.D. Argonne National Lab., IL (USA). [1989]. 15p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From Electrochemical Society fall meeting; Hollywood, FL (USA); 15-20 Oct 1989. Order Number DE90003774. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Lithium-alloy/metal sulfide cells with on molten-halide electrolytes, which are operated in a temperature range of 375-474°C, have undergone many improvements in recent years. Cycle life now exceeds 1000 cycles. The Li-alloy/LiCl-LiBr-KBr eutectic (25:37:38 mol%)/upper-plateau (U.P). FeS_2 cell operated at 400°C has shown excellence performance prospects: 200 Wh/kg specific energy and 200-W/kg specific power. Electrolyte composition has played a dominant role in attaining long-term stable electrochemical performance. A modified LiCl-LiBr-KBr composition (34:32.5:33.5 mol%) was found to exhibit 25% increased ionic conductivity over that of the eutectic. This higher-conductivity electrolyte approximately compensates for the reduced electrolyte content of the electrolyte-starved FeS_2 cell. Such a cell has attained of 95% utilization of U.P. FeS_2 electrode capacity at a comparable cell impedance (0.8-1.0 ohm - cm^2) to that of an the electrolyte-flooded cell. Advancements in cell design and materials application have reduced materials costs and increased battery durability. Both FeS and FeS_2 cell tests have demonstrated overcharge tolerance (3-5 mA/cm^2) for electrolyte-starved operation with MgO powder separators. 12 refs., 7 figs.

5228 (DOE/ER/13675–3) **[Solid state voltammetry and sensors in solids and gases]: Progress report, April 1, 1989–March 31, 1990.** Murray, R.W. North Carolina Univ., Chapel Hill, NC (USA). William R. Kenan, Jr. Labs. of Chemistry. [1989]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-87ER13675. Order Number DE90003234. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We give here a necessarily brief synopsis of our work under the present award. We have 17 solid state voltammetry projects in various stages: two completed prior to initiation of DOE support, six published, one in press, two submitted, four in advanced draft form, and two advanced but still in experimental phase.

5229 (PB–89-873731/XAB) **Nickel-cadmium batteries. January 1977-October 1989 (Citations from the NTIS data base). Report for January 1977-October 1989.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 122p. Available from NTISPC N01/MF N01.

Supersedes PB–89-852750.

This bibliography contains citations concerning the design, fabrication, testing, and applications of nickel-cadmium batteries. Considerable attention is given to the evaluation and development of these batteries for aircraft and spacecraft environments. (This updated bibliography contains 244 citations, 10 of which are new entries to the previous edition.)

29 ENERGY PLANNING AND POLICY

5230 (HQ–1988-AV) **Hydro-Quebec development plan, 1988-1990. 1997 outlook. Abridged version.** Hydro-Quebec, Montreal, PQ (Canada). Mar 1988. 43p. (MICROLOG–89-03171). Available from PC Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, CAN H2Z 1A4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

Hydro-Quebec, a Crown corporation incorporated in 1944, provides Quebec with electric power. It has 19,000 employees and $31 billion worth of assets. Its 80 power plants have a total capacity of 24.5 GW. In 1987, it sold 153 billion kWh of electricity, including 29 billion outside Quebec. This report is aimed at the shareholders, the main partners, and the employees of Hydro-Quebec. It defines the orientations, objectives, and strategies of the company. It deals with the coming ten years, but mainly with the decisions to be made during the next three years. The report summarizes the recovery measures of recent years, and discusses the condition of Quebec and external markets, the operation and development of installations, the management of human resources, the development of new technologies, and financial management. Also discussed are the interactions between the various strategies of Hydro-Quebec and the impacts of the company's activities on its partners and on the community. 12 figs., 12 tabs.

5231 (HQ–1988-FV) **Hydro-Quebec development plan, 1988-1990. 1997 outlook. Full-length version.** Hydro-Quebec, Montreal, PQ (Canada). Mar 1988. 151p. (MICROLOG–89-03171). Available from PC Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, CAN H2Z 1A4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

This plan is aimed at the shareholders, the main partners, and the employees of Hydro-Quebec. It defines the orientations, objectives, and strategies of the company and is intended to encourage co-operation for the beneficiation of hydroelectric energy in Quebec. Though it covers a 10-year span, the plan concentrates on the actions to be undertaken during the first three years, including the strengthening of the recovery actions that began in 1982. The objectives and strategies are essentially the same as in the previous plan. As previously, several scenarios of development have been considered. The uncertainties of the future of the economy, of the exchange rates of the Canadian dollar, and of petroleum prices illustrate the risks involved. The report first draws up a summary of the actions of the last years and of the external context. It then discusses the marketing actions on Quebec markets and the resulting

target of electricity demand, the strategies of external markets development, and the operation and development of installations. It gives an account of Hydro-Quebec's prospects in the fields of technology development and international affairs. It discusses human resource and financial management, especially the financial framework of the years 1988-1990. Finally, the report discusses the impacts of the considered strategies on Hydro-Quebec's partners. 33 figs., 35 tabs.

5232 **Energy and development options: the case of India.** Moulik, T.K. (Indian Institute of Management, Ahmedabad). *Journal of Energy and Development (USA),* 13(2): 239-273 (Spr 1988).

In this paper, the historical processes of evolution of energy policies in India are reviewed in relation to its development plans since independence. Based on the review, an attempt is made to assess the probable scenarios of India's development options in relation to energy parameters. The paper is structured into three distinct time periods: (1) from Indian independence in 1947 until the first oil crisis in 1973; (2) from 1973 to 1986, epitomizing the reactions and responses to the three oil shocks (1973, 1979, and 1986); and (3) the prospects in the future beyond the year 2000. 16 tabs.

2901 Energy Analysis and Modeling

Refer also to citation(s) 4698, 5317, 5356, 5368

5233 (ORNL/FTR–3478) **[Global energy development]: Foreign trip report, October 7–October 21, 1989.** Trivelpiece, A.W.; Fulkerson, W. Oak Ridge National Lab., TN (USA). 21 Nov 1989. 60p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90003381. Available from NTIS, PC A04/MF A01 - OSTI.

This is the report of foreign travel by Alvin W. Trivelpiece and William Fulkerson who were part of a US delegation of ten individuals who visited the Soviet Union for two weeks as part of a joint activity between the US National Academy of Sciences (NAS) and the Academy of Sciences (AS) of the USSR. Trivelpiece headed the US delegation. The trip was sponsored by the NAS under a grant from the MacArthur Foundation. It consisted of three parts: (1) a tour of energy facilities and laboratories in Siberia, including the cities of Novosibirsk, Krasnoyarsk, Nazarovo, Achinsk, Bratsk, and Irkutsk; (2) a joint seminar in Moscow called "Global Energy Development and Associated Ecological (Environmental) Impacts"; and (3) a workshop to discuss areas of potential future collaboration and cooperation. A Memorandum of Record was signed on the final day. It recommended that the Presidents of the two Academies establish a joint committee for "...coordinating, recommending, and encouraging activities in accordance with this memorandum." Projects for possible collaboration were identified in the areas of energy data and models, global warming, technologies for more efficient use of energy, clean coal, gas turbines, tools for assessing environmental impacts, and analysis of approaches to energy decision making.

2902 Economics and Sociology

Refer also to citation(s) 4696, 4716, 5242, 5243, 5244, 5245, 5246, 5247, 5248, 5249, 5250, 5251, 5266, 5267, 5272, 5273, 5274, 5275, 5276, 5281, 5368, 5399, 5400, 6447

5234 (CONF-8811198–, pp. 455-467) **Banca Nazionale del Lavoro (B.N.L. Italy) financial incentives for energy conservation and environmenal protection ENERAMBIENTE.** Rutondi, L. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Order Number DE90724628. Available from NTIS (US Sales Only), PC A19.

This paper outlines the Banca Nazionale del Lavoro (B.N.L., Italy) financial incentive program, ENERAMBIENTE and explains how it relates to overall E.E.C. plans (for the year 1992) promoting, in various sectors (industry, agricolture, etc.), the rational use of energy and environmental protection. The program's objectives are to ensure the prospective user's awareness of the mechanics, possibilities and limits of financial assistence plans, supply technical and organizational assistance and collaborate with local and regional government administrations, as well as public and private enterprises.

5235 (DOE/MI/10132–1) **Labor market analysis and development of a prototype program for minority entrepreneurs: Final report.** Bronx Community Coll., New York, NY (USA). Oct 1989. 71p. Sponsored by U.S. DOE Management & Administration. DOE Contract FG02-88MI10132. Order Number DE90003586. Available from NTIS, PC A04/MF A01 - OSTI.

The US Congress established the office of Minority Economic Impact (MI), in the Department of Energy, to recommend ways to insure that minorities are afforded an opportunity to participate fully in the energy programs of the Department. One undertaking was the development of a prototype technical assistance program plan tailored to encourage, promote, and assist minority business enterprises in establishing and expanding energy related business opportunities among a specific segment of the population with limited education but with a good business sense and potential for success. The concept of the prototype plan was generated by an unsolicited proposal submitted to the Department of Energy by the Business and Professional Development Institute of the Bronx Community College (City University of New York) to MI, entitled "Labor Market Analysis and Development of A Prototype Program for Entrepreneurs." Since Bronx Community College is one of the many educational institutions around the country with special programs and resources capable of generating such a plan, the Business and Professional Development seemed to possess the desired qualifications, experience, location and public and private associations necessary to effectively accomplish the study.

5236 (PB–89-224968/XAB) **Analysis of new manufacturing plants in Appalachia: Why do they locate here and what makes them successful. Final report.** Walker, R.; Greenstreet, D.; Calzonetti, F. West Virginia Univ., Morgantown, WV (USA). Dept. of Geology. Jul 1989. 71p. Available from NTIS, PC A04/MF A01.

This report presents findings of a study funded by the Appalachian Regional Commission (ARC) to investigate growth dynamics and location decisions of manufacturing establishments new to ARC. A statistical analysis of location decisions shows that at the margin, a location that offers an incentive or incentives stands a greater chance of attracting a plant than a next-best alternative that does not, provided other characteristics of the locations–such as wage rates and skill levels of workers–do not vary appreciably. Respondents to a questionnaire indicated that a government incentive, such as a tax break or job training subsidy, provide decisive during their location decision. The study also found that property tax rates may act as a deterrent to the choice of a location in other than a metropolitan area. The rate of job growth is best explained by a plant's initial size and age, which reflects both life-cycle and business-cycle effects: plants making a relatively large percentage of their sales out of state tend to be fast growers. A difficult-to-define management quality is important to the growth of jobs, according to the study.

5237 (QAERC–760/821) **Energy: Costs of energy sources and of dual energy.** Quebec Agricultural Economic Reference Committee, Laval, PQ (Canada). 1987. 4p. (MICROLOG–89-03131). Available from PC Quebec (Province). Ministere de l'agriculture, des pecheries et de l'alimentation, 200A, chemin Ste-Foy, Quebec, PQ, CAN G1R 4X6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $2.00 CAN; MF $10 CAN.

This report, published by the Quebec Ministry of Agriculture, Fisheries and Food, provides a method of comparing the costs of producing a given amount of useful energy from various energy sources, given the specific cost of each energy source and the efficiency of the transformation of one form of energy into another. The energy sources considered are propane, natural gas, number 2 oil, softwood, hardwood and electrical power. A special calculation is

presented for dual energy, i.e. electrical power plus another form of energy, for which the elctricity rate is lower. 1 fig., 2 tabs.

2903 Environment, Health, and Safety

Refer also to citation(s) 4721, 4722, 4926, 5234, 5266, 5267, 5368, 5646, 5846, 5952

5238 (EC–CCD88-06) **Estimating effects of climatic change on agriculture in Saskatchewan, Canada.** Williams, G.D.V; Fautley, R.A.; Jones, K.H.; Stewart, R.B.; Wheaton, E.E. Environment Canada, Ottawa, ON (Canada). 1988. 36p. (MICROLOG–89-03735). Available from PC Climate Program Office, Canadian Climate Centre, 4905 Dufferin Street, Downsview, ON, CAN N9B 3P4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

A study was conducted to illustrate the applicability of several models in the impact analysis of climatic changes or fluctuations on Saskatchewan agriculture, to quantify those impacts, and to consider some policy responses to adapt to those impacts. Three broad types of climatic scenarios were selected for the model: a single anomalous weather-year taken from the historical record; an extreme period of weather-years from historical records; and a climate simulated using results from an atmospheric general circulation model which included a doubling of atmospheric carbon dioxide. The latter model results indicated general increases of precipitation in Saskatchewan accompanying the increases in temperature with carbon dioxide doubling. On the assumption that carbon dioxide warming might occur without increased precipitation, in agreement with the historical observation that low precipitation and high temperatures tend to occur in the same summers, an alternate scenario was also developed to take this possibility into account. Impacts of the various scenarios are outlined with respect to degree days, precipitation effectiveness, biomass potential, wind erosion potential, spring wheat production, agricultural expenditures, and agricultural employment. Results indicate that a shift to a longer-term warm climate with precipitation increases, without major changes in agriculture, would reduce wheat yields by 16%, causing annual losses to agriculture of over $160 million. A shift to a longer-term warm climate without precipitation increases would cause all impacts to be generally adverse and more intense, particularly as a consequence of increased drought frequency and severity. 3 tabs.

5239 (HQ–89-03211) **Environment and development [Hydro-Quebec].** Hydro-Quebec, Montreal, PQ (Canada). [1989]. 31p. (MICROLOG–89-03211). Available from PC Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, CAN H2Z 1A4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Hydro-Quebec is the provincial electric utility in the Province of Quebec. This brochure describes the mandate and structure of Hydro-Quebec's environment team, the methods and tools used, the types of studies done, areas of expertise, and management strengths. Research activities include location and impact studies for power lines, power stations, substations; and hydroelectric power dams; computerized models; methods for studying ecological aspects of forest and wildlife, and pollution control methods, especially for polychlorinated biphenyls.

5240 (HQ–D89-0009) **Hydro-Quebec development plan, 1989-1991. 1998 outlook: Hydro-Quebec and the environment.** Hydro-Quebec, Montreal, PQ (Canada). Mar 1989. 71p. (MICROLOG–89-03176). Available from PC Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, CAN H2Z 1A4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This plan describes the orientations that are favored by Hydro-Quebec, including those aimed at the protection and beneficiation of the environment, within the framework of its activities. The plan summarizes briefly the history of the environmental function within the corporation since the beginning of the 70s. It describes the main environmental concerns of the corporation, which include: mercury pollution, research on salmon and ouananiche, research on the effects of electric electric and magnetic fields, research on cumulative environmental effects, the improvement of practices in the agricultural sector (including the results of the 1986 agreement with the Quebec Agricultural Producers' Union), and the external cooperation with other utilities in Quebec, Canada, and abroad (including technology transfer activities). The two main environmental preoccupations at Hydro-Quebec for the next three years will be the integration of the concept of lasting development, and the education and conscientization of managers, employees, and partners of the corporation. 1 ref., 7 figs., 9 tabs.

5241 (NTRR–89-03720) **An evaluation of the Norman Wells project.** Mathews, S.B.; Larson, R.M. Northwest Territories Dept. of Renewable Resources, Yellowknife, NT (Canada). 1987. 107p. (MICROLOG–89-03720). Available from PC Northwest Territories. Dept. of Renewable Resources, P.O. Box 1320, Yellowknife, NT, CAN X1A 2L9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Following construction of the Norman Wells Oilfield Expansion and Pipeline Project, the Department conducted a performance evaluation of the project. The evaluation examined the public hearing process, the National Energy Board's conditional approval process, project management, and impact management. Information was obtained from government files, through questionnaires, and from personal experience. Each process was assessed, issues were identified, and recommendations were provided to improve the process, with 47 recommendations directed to the Department, other government agencies, and industry. Specific areas which required improvement included participation in public hearings, the National Energy Board's conditional approval process, project planning and preparation, communication and cooperation among project personnel including government and industry staff, and environmental protection and monitoring. Seven recommendations were directed to existing Departmental programs in pollution control, wildlife management, conservation eduction, and environmental monitoring. The evaluation also highlighted positive aspects of the project, including the responsible actions of Esso and Interprovincial Pipe Line during construction in minimizing environmental impacts. Appendices include the sequence of major events, a summary of issues associated with pipeline development in the Mackenzie Valley, and a list of abbreviations. 13 refs.

5242 (PB–89-232201/XAB) **Socio-economic and environmental inventory of the north Atlantic region - Sandy Hook to Bay of Fundy.** Research Inst. of the Gulf of Maine, Portland, ME (USA). Nov 1974. 5148p. Available from NTIS, PC EE99/MF E99.

Set includes PB–89-232219 through PB–89-232292.

A separate abstract was prepared for each of the 7 volumes of this set.

5243 (PB–89-232219/XAB) **Socio-economic and environmental inventory of the North Atlantic Region including the outer continental shelf and adjacent waters from Sandy Hook, New Jersey, to Bay of Fundy. Volume 1. Executive summary. Final report.** Maciolek-Blake, N.; Grassle, J.F.; Neff, J.M. Battelle New England Marine Research Lab., Duxbury, MA (USA). Nov 1974. 87p. Available from NTIS, PC A05/MF A01.

See also Volume 1, Book 1, PB–89-232227; Also available in set of 9 reports PC E99, PB–89-232201.

Concerns about the potential effects of oil- and gas-exploration activities on Georges Bank led to the initiation of a monitoring program in July 1981. The program included sampling of the benthic communities near, upcurrent, and downcurrent of the drilling rigs, analysis of bottom photographs for epifauna and microtopography, trawl collections, total organic carbon, and sediment grain size analysis. Six replicate samples were collected with a 0.04 sq m Van Veen grab sampler at 46 stations on a seasonal basis. Twenty-nine stations were positioned in a tight radial array around a rig at 80 m. A second group of three stations were near a rig site at 140 m. The remaining stations covered a broad expanse of the Bank and nearby areas of potential deposition of drilling materials. Additional aspects of this program included a detailed life-history analysis of 23 dominant species, and a study which linked fish feeding with

benthic production. Bottom photographs revealed depth-related patterns of microtopography and confirmed the patchy distribution of the sand dollar, Echinarachnius parma, as documented from the grab samples. Eight dry wells were drilled to date in the Lease Sale 42 area. No biological impacts that could be attributed to drilling activities were detected at any station.

5244 (PB–89-232227/XAB) **Socio-economic and environmental inventory of the north Atlantic region including the outer continental shelf and adjacent waters from Sandy Hook, New Jersey to Bay of Fundy. Volume 1. Book 1.** Research Inst. of the Gulf of Maine, Portland, ME (USA). Nov 1974. 553p. Available from NTIS, PC A24/MF A01.

See also Executive Summary, PB–89-232219 and Volume 1, Book 2, PB–89-232235. Also available in set of 9 reports PC E99, PB–89-232201.

A 10-month study by the Research Institute of the Gulf of Maine (TRIGOM) was conducted to gather and inventory the existing environmental socio-economic data of the coastal zone and adjacent outer continental shelf (OCS) from Sandy Hook, New Jersey to Bay of Fundy. These data were based on the requirements for impact assessments prior to leasing offshore areas for oil, gas, and mineral exploration and production. The marine boundaries were Hudson Canyon, the 200-meter contour, and the Canadian international line; shoreward, the limit of salt intrusion was the boundary while some 38 counties were inventoried for socio-economic data. Over 300 persons were contacted or interviewed, 3800 documents reviewed for data by about 40 scientists and consultants. The major topics inventoried and presented in the report are environmental, systems ecology by habitat, unique and endangered environments, environmental quality, and socio-economics.

5245 (PB–89-232235/XAB) **Socio-economic and environmental inventory of the north Atlantic region including the outer continental shelf and adjacent waters from Sandy Hook, New Jersey to Bay of Fundy. Volume 1. Book 2.** Research Inst. of the Gulf of Maine, Portland, ME (USA). Nov 1974. 814p. Available from NTIS, PC A99/MF E04.

See also Volume 1, Book 1, PB–89-232227 and Volume 1, Book 3, PB–89-232243; Also available in set of 9 reports PC E99, PB–89-232201.

A 10-month study by the Research Institute of the Gulf of Maine (TRIGOM) was conducted to gather and inventory the existing environmental socio-economic data of the coastal zone and adjacent outer continental shelf (OCS) from Sandy Hook, New Jersey to Bay of Fundy. These data were based on the requirements for impact assessments prior to leasing offshore areas for oil, gas, and mineral exploration and production. The marine boundaries were Hudson Canyon, the 200-meter contour, and the Canadian international line; shoreward, the limit of salt intrusion was the boundary while some 38 counties were inventoried for socio-economic data. The major topics inventoried and presented in the report are environmental, systems ecology by habitat, unique and endangered environments, environmental quality, and socio-economics.

5246 (PB–89-232243/XAB) **Socio-economic and environmental inventory of the north Atlantic region including the outer continental shelf and adjacent waters from Sandy Hook, New Jersey, to Bay of Fundy. Volume 1, Book 3.** Research Inst. of the Gulf of Maine, Portland, ME (USA). Nov 1974. 824p. Available from NTIS, PC A99/MF E04.

See also Volume 1, Book 2, PB–89-232235 and Volume 1, Book 4, PB–89-232250. Also available in set of 9 reports PC E99, PB–89-232201.

A 10-month study by the Research Institute of the Gulf of Maine (TRIGOM) was conducted to gather and inventory the existing environmental socio-economic data of the coastal zone and adjacent outer continental shelf (OCS) from Sandy Hook, New Jersey to Bay of Fundy. These data were based on the requirements for impact assessments prior to leasing offshore areas for oil, gas, and mineral exploration and production. The marine boundaries were Hudson Canyon, the 200-meter contour, and the Canadian international line; shoreward, the limit of salt intrusion was the boundary while some 38 counties were inventoried for socio-economic data. The major topics inventoried and presented in the report are environmental, systems ecology by habitat, unique and endangered environments, environmental quality, and socio-economics.

5247 (PB–89-232250/XAB) **Socio-economic and environmental inventory of the north Atlantic region including the outer continental shelf and adjacent waters from Sandy Hook, New Jersey to Bay of Fundy. Volume 1, Book 4.** Research Inst. of the Gulf of Maine, Portland, ME (USA). Nov 1974. 620p. Available from NTIS, PC A99/MF A01.

See also Volume 1, Book 3, PB–89-232243 and Volume 1, Book 5, PB–89-232268; Also available in set of 9 reports PC E99, PB–89-232201.

A 10-month study by the Research Institute of the Gulf of Maine (TRIGOM) was conducted to gather and inventory the existing environmental socio-economic data of the coastal zone and adjacent outer continental shelf (OCS) from Sandy Hook, New Jersey to Bay of Fundy. These data were based on the requirements for impact assessments prior to leasing offshore areas for oil, gas, and mineral exploration and production. The marine boundaries were Hudson Canyon, the 200-meter contour, and the Canadian international line; shoreward, the limit of salt intrusion was the boundary while some 38 counties were inventoried for socio-economic data. The major topics inventoried and presented in the report are environmental, systems ecology by habitat, unique and endangered environments, environmental quality, and socio-economics.

5248 (PB–89-232276/XAB) **Socio-economic and environmental inventory of the north Atlantic region including the outer continental shelf and adjacent waters from Sandy Hook, New Jersey to Bay of Fundy. Volume 2.** Research Inst. of the Gulf of Maine, Portland, ME (USA). Nov 1974. 843p. Available from NTIS, PC A99/MF E04.

See also Volume 1, Book 5, PB–89-232268 and Volume 3, Book 1, PB–89-232284; Also available in set of 9 reports PC E99, PB–89-232201.

A 10-month study by the Research Institute of the Gulf of Maine (TRIGOM) was conducted to gather and inventory the existing environmental socio-economic data of the coastal zone and adjacent outer continental shelf (OCS) from Sandy Hook, New Jersey to Bay of Fundy. These data were based on the requirements for impact assessments prior to leasing offshore areas for oil, gas, and mineral exploration and production. The marine boundaries were Hudson Canyon, the 200-meter contour, and the Canadian international line; shoreward, the limit of salt intrusion was the boundary while some 38 counties were inventoried for socio-economic data. The major topics inventoried and presented in the report are environmental, systems ecology by habitat, unique and endangered environments, environmental quality, and socio-economics.

5249 (PB–89-232284/XAB) **Socio-economic and environmental inventory of the north Atlantic region including the outer continental shelf and adjacent waters from Sandy Hook, New Jersey to Bay of Fundy. Volume 3, Book 1.** Research Inst. of the Gulf of Maine, Portland, ME (USA). Nov 1974. 744p. Available from NTIS, PC A99/MF E04.

See also Volume 2, PB–89-232276 and Volume 3, Book 2, PB–89-232292. Portions of this document are not fully legible; Also available in set of 9 reports PC E99, PB–89-232201.

A 10-month study by the Research Institute of the Gulf of Maine (TRIGOM) was conducted to gather and inventory the existing environmental socio-economic data of the coastal zone and adjacent outer continental shelf (OCS) from Sandy Hook, New Jersey to Bay of Fundy. These data were based on the requirements for impact assessments prior to leasing offshore areas for oil, gas, and mineral exploration and production. The marine boundaries were Hudson Canyon, the 200-meter contour, and the Canadian international line; shoreward, the limit of salt intrusion was the boundary while some 38 counties were inventoried for socio-economic data. The major topics inventoried and presented in the report are environmental, systems ecology by habitat, unique and endangered environments, environmental quality, and socio-economics.

5250 (PB–89-232292/XAB) **Socio-economic and environmental inventory of the north Atlantic region including the outer continental shelf and adjacent waters from Sandy Hook, New Jersey to Bay of Fundy. Volume 3, Book 2.** Research Inst.

of the Gulf of Maine, Portland, ME (USA). Nov 1974. 100p. Available from NTIS, PC A05/MF A01.

See also Volume 3, Book 1, PB–89-232284; Also available as a set of 9 reports PC E99, PB–89-232201.

A 10-month study by the Research Institute of the Gulf of Maine (TRIGOM) was conducted to gather and inventory the existing environmental socio-economic data of the coastal zone and adjacent outer continental shelf (OCS) from Sandy Hook, New Jersey to Bay of Fundy. These data were based on the requirements for impact assessments prior to leasing offshore areas for oil, gas, and mineral exploration and production. The marine boundaries were Hudson Canyon, the 200-meter contour, and the Canadian international line; shoreward, the limit of salt intrusion was the boundary while some 38 counties were inventoried for socio-economic data. The major topics inventoried and presented in the report are environmental, systems ecology by habitat, unique and endangered environments, environmental quality, and socio-economics.

5251 (PB–89-233316/XAB) **People and trees: The role of social forestry in sustainable development. Seminar series.** Gregersen, H.; Draper, S.; Elz, D. International Bank for Reconstruction and Development, Washington, DC (USA). Economic Development Inst. 1989. 279p. Available from NTISMF A01.

Library of Congress catalog card No. 89-9047; Microfiche copies only. Paper copy available from World Bank, 1818 H St., NW, Washington, DC 20433.

This book was written for two main reasons. First, EDI's preparatory work for two courses on forestry projects revealed the need for a publication that brings together developing countries' recent experiences with social-forestry programs and projects and that presents the material in a manner that would be useful for people working in this field. The second reason is somewhat more startling. Data produced for the courses indicated that investments in forestry and tree growing will have to be enormous in the medium-term future to achieve a reasonable balance between requirements for environmental stability and local demands for forest and tree products. The authors have brought out the issues or problems encountered and have given examples of what to look for and how to go about solving problems. They hope that the book will help set in motion accelerated programs of social forestry and other developments that bring together trees and farming systems.

5252 (RCP–61087-Pt.1) **Manitoba Hazardous Waste Management Corporation system scope and technology study: Part 1. Strategy review.** Reid Crowther and Partners Ltd., Winnipeg, MB (Canada). 1988. 45p. (MICROLOG–89-02966). Available from PC Manitoba Hazardous Waste Management Corporation, 226-530 Century Street, Winnipeg, MB, CAN R3H 0Y4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

The Manitoba Hazardous Waste Management Corporation is charged with the responsibility of implementing a hazardous waste management system in the province. A review was undertaken of the planning work performed to date and of the Corporation's development strategy. The evaluation was based on a review of the literature and on experience with hazardous waste planning, management, and engineering. To facilitate evaluation, the development strategies were visualized as made up of 3 logical components: the mechanisms or business vehicles used; the rates of development employed; and the geographical locations in which the activities take place. Based on ownership or funding source, 3 business development options were identified: public corporation, private enterprise, and joint venture. The only two options possible in terms of rate of development are incremental and immediate. Only 3 general locations were considered: in Manitoba, outside Manitoba, or a combination of both. Results showed that a joint venture is a good option since it offers a good tradeoff to minimize expenditures between public and private financing, and it enables combining the flexibility and freedom of action of a private corporation with the responsibility of a public corporation. The incremental approach provides more flexibility than immediate development and is the most practical solution to the many uncertainties of the hazardous waste problem. This approach is nominally more costly because it takes longer and cannot capitalize on economies of scale, but it also minimizes the risk of making the wrong capital investment and is therefore a safer investment approach. 105 refs. 28 figs., 15 tabs.

5253 (RCP–61087-Pt.2) **Manitoba Hazardous Waste Management Corporation system scope and technology study: Part 2. Technology review.** Reid Crowther and Partners Ltd., Winnipeg, MB (Canada). 1988. 202p. (MICROLOG–89-02966). Available from PC Manitoba Hazardous Waste Management Corporation, 226-530 Century Street, Winnipeg, MB, CAN R3H 0Y4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

The Manitoba Hazardous Waste Management Corporation is charged with the responsibility of implementing a hazardous waste management system in the province. A review was undertaken of the planning work performed to date and of the Corporation's development strategy. The evaluation was based on a review of the literature and on experience with hazardous waste planning, management, and engineering. To facilitate evaluation, the development strategies were visualized as made up of 3 logical components: the mechanisms or business vehicles used; the rates of development employed; and the geographical locations in which the activities take place. Based on ownership or funding source, 3 business development options were identified: public corporation, private enterprise, and joint venture. The only two options possible in terms of rate of development are incremental and immediate. Three general locations were considered; in Manitoba, outside Manitoba, or a combination of both. Results showed that a joint venture is a good option since it offers a good tradeoff to minimize expenditures between public and private financing, and it enables combining the flexibility and freedom of action of a private corporation with the responsibility of a public corporation. The incremental approach provides more flexibility than immediate development and is the most practical solution to the many uncertainties of the hazardous waste problem. This approach is nominally more costly because it takes longer and cannot capitalize on economies of scale, but it also minimizes the risk of making the wrong capital investment and is therefore a safer investment approach. 108 refs., 28 figs., 15 tabs.

5254 **Energy development in environmental dynamics.** Sarlos, G. (Ecole polytechnique federale, Lausanne (CH)); Verstraete, P. *Revue de l'Energie (France)*, 40(413): 633-658 (Aug-Sep 1989).

Energy is one amongst the primary factors of economy and represents thus one of the means giving access to the development of our societies. In order to determine the physical frame of this development, it should however be reminded that energy is taken from the environment, transformed, used and then almost totally released to the environment as various degraded forms of waste and heat. As the world primary energy consumption, presently 10 TWyr/yr for a population of 5 billions increases because of the improvement of the standard of living and the demographical growth, it should be expected, within one century from now, that the world energy consumption will reach 20 to 30 TWyr/yr for a population twice that of today. The energy related releases to the environment will thus be doubled or even tripled, which may incur disastrous repercussions on the environment at a global scale as well as that of large consumption centers. In this perspective, being understood that energy is already perceived, correctly indeed, as being at the origin of an important share of the attacks to the environment, the relations between energy and environment are a subject of major concern. There are also objective situations characterized by attacks on the environment which are observable and measurable, such as the concentration of pollutants in air or water, the attacks to the landscape or also the depletion of energy resources.

2904 Energy Resources

Refer also to citation(s) 4916, 5251

2905 Research, Development, Demonstration, and Commercialization

Refer also to citation(s) 4918, 4937, 4938, 4945, 4946, 4948, 4949, 5213, 5235, 5285, 5309, 5316, 5324, 5390, 5897, 5898, 5899

5255 (CONF-8811198–, pp. 33-46) **The commercialization of energy saving building technology in Italy: Program management.** De Pascali, P. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceedings of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Order Number DE90724628. Available from NTIS (US Sales Only), PC A19.

The Author cites some examples of demonstration projects in which new innovations in solar architecture were proven in Italy. After an assessment of the current situation with regard to national research programs and the commercialization of solar building technology, he stresses the need for training in this field at the university level and in industry, as well as the necessity for a greater effort on the part of the Government to inform the public of the energy savings to be derived from the use of this technology and to provide well planned assistance programs to builders.

5256 (CONF-8811198–, pp. 13-17) **First and second generation bio-climatic buildings in Italy (Government assistance program).** D'Errico, E. (ENEA, Casaccia (Italy). Dipt. Fonti Alternative e Risparmio Energetico); Funaro, G. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic achitecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Order Number DE90724628. Available from NTIS (US Sales Only), PC A19.

Since 1980, the Italian Government has been providing legal incentives, as well as financial and technical assistance for the incorporation of passive solar systems in existing and new buildings as part of an overall energy conservation policy. This report discusses ENEA (Italian Commission for Alternative Energy Sources) activities carried out within the framework of the nation-wide program for the promotion of solar architecture technology utilization. The activities include: the collection of statistical data on new bioclimatic construction; a systematic appraisal of the results (technical-economical evalutations); research development and commercialization of new solar architecture systems and relevant building materials.

5257 (DOE/ER–0427) **Advanced Energy Projects FY 1989 research summaries.** USDOE Office of Energy Research, Washington, DC (USA). Advanced Energy Projects Div. Sep 1989. 30p. Sponsored by U.S. DOE Energy Research. Order Number DE90003304. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This report is a guide to proposal preparation and a list of summaries of research programs for the US DOE Advanced Energy Projects. (JEF)

5258 (EMR/ER–8805) **Energy Research Laboratories annual report, 1987-88.** Harcourt, J.L. (ed.). Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Energy Research Labs. 1988. 118p. (MICROLOG–89-00495). Available from PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The Energy Research Laboratories have been responding to the need for developing technologies related to fossil fuels and synthetic fuels. This report summarizes the Laboratories' activities for the current fiscal year. Objectives and achievements in a variety of subprograms of the three main divisions are outlined: combustion and carbonization, synthetic fuels, and fuel characterization. Subprogram areas include bitumen and heavy oil recovery and upgrading, conversion of natural gas to liquid fuels, coprocessing and coal conversion technologies, fluidized bed combustion, gasification, and biomass fuels for residential and industrial use. Support services are also described, and lists of staff, publications, presentations, contracts, and consultations are included. 1 fig.

5259 (PB–89-225346/XAB) **Transfer of advanced manufacturing technologies to eastern Kentucky industries.** Gillies, J.A.; Kruzich, R. Mountain Association for Community Economic Development, Inc., Berea, KY (USA). May 1988. 129p. Available from NTIS, PC A07/MF A01.

This study concludes that there are opportunities to provide assistance in the adoption of manufacturing technologies for small- and medium-sized firms in eastern Kentucky. However, the new markets created by Toyota are not adequate to justify a directed technology transfer program targeting the auto supply industry in eastern Kentucky because supplier markets have been determined for some time, and manufacturers in eastern Kentucky were not competitive in this early selection process. The results of the study strongly reinforce a reorientation of state business-assistance programs. The study also concludes that the quality and quantity of available labor is a pervasive problem in eastern Kentucky and has particular relevance as the economy changes. The study also investigated what type of technology-transfer programs would be appropriate to assist manufacturing firms in eastern Kentucky and if there were a critical number of firms to make such a program feasible.

2906 Nuclear Energy

Refer also to citation(s) 4881, 5110, 5266, 5267, 5271, 5399, 5400, 5401

5260 (INIS-BR–1693) **Nuclear option and the technical and economical viability for constructing small nuclear power reactors in some brazilian regions.** Santos, E.M. dos (Universidade Estadual de Campinas, SP (Brazil). Planejamento Energetico); Maiorino, J.R. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). 1989. 15p. (In Portuguese). (CONF-8905242–: 1. Brazilian congress on Energy Planning, Campinas (Brazil), 8-12 May 1989). Order Number DE90608856. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The necessity of a large technological revolution in the nuclear energy management is analysed. The potential of small and medium nuclear power reactors - 100MW(e) and 300 MW(e) is studied.

5261 (SIS–1989:1) **Chernobyl accident, a catastrophe or an eye-opener?.** Baarli, J. Statens Inst. for Straalehygiene, Oslo (Norway). 1989. 42p. (In Norwegian). Order Number DE90610374. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The Chernobyl accident is reviewed as to its cause, the way it was handled locally and the consequenses from released radioactivity. It is emphasized that the exposure from the released radioactivity, as to the effective dose equivalent and the committed dose equivalent is small and comparable with the dose equivalent from natural ionizing radiation near the accident, and only a few per cent of this value at more remote distances. It is concluded that the accident probably has been one of the greatest psychological catastrophes that we so far has experienced, but not so when referring to early deaths or radiation damage directly to individuals.

5262 **The role of civil defense - 1986.** Chester, C.V. (Oak Ridge National Lab. (US)). vp of Strategic defenses and arms control. Weinberg, A.M.; Barkenbus, J.N Paragon House Pubs., New York, NY (1988).

President Reagan's proposal for a Strategic Defense Initiative has reopened the debate on the role of active defenses in strategic arms policy. Questions concerning the technical feasibility of active defense, its effect on crisis- and arms-race stability and its interaction with arms control are all being vigorously discussed. Curiously, passive defense has hardly been mentioned in the debate. By passive defense the authors mean civil defense; the array of shelters and other measures that protect people and in some cases industry against destruction by nuclear weapons. The emphasis in this paper is on permanent shelter since it completely dominates the cost structure and deployment time of most civil defense programs. This

discussion will review the state of the art and status of civil defense, speculate on its potential interaction with the Strategic Defensive Initiative and its implications for arms control.

5263 **With dosimeter in the sarcophagus.** Kanin, Y. *Nature (London) (UK)*, 339(6221): 171-172 (18 May 1989).

Three years after the Chernobyl reactor accident, a trip between Kiev Pripyat and Chernobyl is described. The attitudes of workers at the plant and local residents to radiation hazards is noted. Research being carried out locally may offer new insights and help prevent similar accidents in future. (UK).

2908 Heat Utilization

Refer also to citation(s) 5360

2910 Conservation

Refer also to citation(s) 4696, 5234, 5266, 5267, 5315, 5347, 5348, 5356

2920 Supply, Demand, and Forecasting

Refer also to citation(s) 4696, 4715, 5266, 5267, 5271, 6390

5264 (NEDOJ–P-8832) **Study for promotion on effective use of energy in cities.** New Energy Development Organization, Tokyo (Japan). Mar 1989. 249p. (In Japanese). Order Number DE90725118. Available from NTIS (US Sales Only), PC A11.

Big cities represented by Tokyo, are facing various kinds of problems due to their cumulative population. As far as the energy supply system is concerned, efficient countermeasures to meet rapid increase of energy demand for commercial use and building-up of an effective energy supply system to satisfy all diversified needs are seriously required. In order to elucidate these problems, study for promotion on effective use of energy in cities, has been conducted by Mitsubishi Research Inst., Inc. as a contract research from NEDO. Elucidation of the present situation on energy supply in urban areas of Tokyo and investigation of proper energy supply systems after due consideration of future socioeconomic trends, were carried out in the study. In future, it is planed to apply the energy supply systems definitely to urban areas giving consideration to the local specialties, and is also intended to enlarge the application areas after many-sided evaluations and investigations. 137 figs., 87 tabs.

2930 Policy, Legislation, and Regulation

Refer also to citation(s) 4704, 5106, 5234, 5241

5265 (APUB–89-03789) **Alberta Public Utilities Board annual report, 1988.** Alberta Public Utilities Board, Edmonton, AB (Canada). 1989. 81p. (MICROLOG–89-03789). Available from PC Public Utilities Board for the Province of Alberta, 10055-106th St., 11th Floor, Edmonton, Alta., CAN T5J 2Y2; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

The Alberta Public Utilities Board is responsible for regulating all telecommunications, electric, water and gas utilities in Alberta, with certain exceptions, such as municipally owned utilities. The Board's primary purpose in regulating utilities under its jurisdiction is to ensure that the utilities' customers receive safe and adequate service at rates which are just and reasonable to both the customers and investors of those utilities. As part of the regulatory process, the Board is responsible for reviewing the affairs, earnings or accounts of public utilities, and for exercising general supervision of such utilities and ensuring their compliance with the law. The Board has also been assigned a number of other regulatory responsibilities, including: pricing and rate determination and arbitration; conducting hearings; approving franchise agreements, supply contracts and taxation agreements between municipal councils and utilities; serving as an appellate tribunal with respect to certain disputes involving gas transportation; performing compensation fixing duties with respect to pollution and environmental damage claims; and approval of tariffs and tolls of intraprovincial railways. The Board may also be directed to hold inquiries into areas under its jurisdiction and report thereon. This report outlines the Board's s activities for the year and includes summaries of hearings, inquiries, applications, appeals, decisions, and related matters.

5266 (DOE/CH/10348–1, pp. 9-15) **Energy security and national policy.** Martin. W.F. (Dept. of Energy). Illinois Univ., Chicago, IL (USA). Energy Resources Center. 1987. (CONF-8711295–: 15. annual Illinois energy conference: transition to an energy secure economy, the changing economic and regulatory scene, Chicago, IL (USA), 10-11 Nov 1987). In *Transition to an energy secure economy: The changing economic and regulatory scene. Proceedings.* Order Number DE89008864. Available from NTIS, PC A09/MF A01.

To achieve an energy secure future, energy cannot be viewed as an isolated concern. It is part and parcel of a nation's economic, social, and political context. In the past important implications for the economy and national security have been ignored. Crash programs to deal with oil shortages in the seventies, crashed. In the eighties, oil surplus has been enjoyed. The energy situation could be quite different in the nineties. Statistics on energy supply and consumption of oil, coal, natural gas and electricity from nuclear power show that much progress has been made worldwide. However, about half of the world's oil will come from the Persian Gulf by 1995. Continued low oil prices could raise US imports to 60% of consumption by 1995. Persian Gulf tensions serve as reminders of the link between energy policy and national security policy. Energy policy must be based on market forces and concerns for national security. Strategic oil reserves will expand along with the availability of domestic oil and gas resources. Increased attention to conservation, diversification of energy resources, and use of alternative fuels can help reduce imports. Continued high-risk long term research and development is needed. Improved technology can reduce environmental impacts. Global markets need global cooperation. Energy has emerged as an important aspect of East-West relations. Europeans need to diversify their sources of energy. The soviets have proposed expanded collaboration in magnetic fusion science. A series of initiatives are proposed that together will ensure that economies will not become overly dependent on a single source of energy.

5267 (DOE/CH/10348–1, pp. 17-24) **Requirements for an energy policy.** Conant, M.A. Illinois Univ., Chicago, IL (USA). Energy Resources Center. 1987. (CONF-8711295–: 15. annual Illinois energy conference: transition to an energy secure economy, the changing economic and regulatory scene, Chicago, IL (USA), 10-11 Nov 1987). In *Transition to an energy secure economy: The changing economic and regulatory scene. Proceedings.* Order Number DE89008864. Available from NTIS, PC A09/MF A01.

The central issue facing the US today lies in the rise of oil imports. No supergiant (5 billion barrels) oil discoveries have been made in the US. Production from existing fields is declining. The 1985-86 oil price collapse from $26 to less than $15 per barrel had a disastrous effect on the budgets of smaller oil companies which do most of the exploring, and on the service industry. Budgets for overseas exploration has been generally sustained. Oil prices are not expected to sustain domestic exploration. Gulf oil sources will, in the next five years, supply some 75 percent of all oil in international trade. Without an energy policy, involvement in Middle East oil will grow exponentially, as will the needs of others for Gulf oil. The natural gas situation is different, with a spare producing capacity of one trillion cubic feet this year, which could double next year. Natural gas deregulation has created an unbelievable mess in the requirements of producers/suppliers and purchasers to have dependable business arrangements. Coal is plentiful and will be until the end of time. Public opposition to emission problems and the greenhouse effect are an obstacle to greater use of coal. The nuclear option may be dead, with no new orders since 1978. Statistics are provided on proven world reserves of conventional crude oil, recoverable heavy oils, tar sands, and shale oil; which indicates for the long term an ability to transform the Geopolitics of oil away from the middle east. Energy options require energy R&D, use of Alaskan gas, conservation and efficiency in energy use, strategic reserves, close energy relations with allies, and a government-industry link which insures meeting the US oil needs from the Western Hemisphere.

5268 (RAC–89-02371) **A recycling strategy for Ontario: Discussion paper.** Recycling Advisory Committee, Hamilton, ON

(Canada). Jan 1989. 43p. (MICROLOG–89-02371). Available from PC Ontario Ministry of the Environment, Public Information Office, 135 St. Clair Ave. West, Toronto, ON, CAN M4V 1P5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The Ontario Ministry of the Environment is developing a broad Ontario Waste Abatement Strategy which is expected to address all elements of waste, including residential, commercial, industrial, institutional, construction, demolition, medical, and others. The full report is expected to be released in 1989, encompassing legislative, financial, technical, research, waste management facilities, and enforcement and monitoring. This discussion paper addresses the increased recovery and recycling of those materials which are now generated as municipal solid wastes, primarily from homes but also including the institutional and commercial establishments for which a local government has responsibility. The paper summarizes the rationale for the narrow focus, presents additional considerations which favour immediate efforts to increase the recycling of municipal waste now, and details the target wastes. Thirteen guiding principles are outlined, and broad recommendations for action are included. 2 figs., 5 tabs.

2940 Fossil Fuels

Refer also to citation(s) 4633, 4647, 4666, 4669, 4675, 4696, 4713, 4719, 5241, 5242, 5243, 5244, 5245, 5246, 5247, 5248, 5249, 5250, 5265, 5283

5269 (DOE/EIA–0035(89/08)) **Monthly energy review.** US-DOE Energy Information Administration, Washington, DC (USA). Aug 1989. 142p. Sponsored by U.S. DOE Management & Administration. Order Number DE90003406. Available from NTIS, PC A07/MF A01 - GPO - OSTI; GPO Dep.

The Monthly Energy Review presents current data on production, consumption, stocks, imports, exports, and prices of the principal energy commodities in the United States. Also included are data on international production of crude oil, consumption of petroleum products, petroleum stocks, and production of electricity from nuclear-powered facilities.

5270 (DOE/FE–0153) **Western fossil fuels R and D public meeting: Summary proceedings.** USDOE Office of Energy Research, Washington, DC (USA). Oct 1989. 78p. Sponsored by U.S. DOE Fossil Energy. Order Number DE90003305. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

A public meeting was convened by the Department of Energy (DOE) in Denver, Colorado, on Wednesday, July 26, 1989, at The Registry Hotel, in order to obtain public views and comments on the development of techniques which could offer the potential to improve the economic competitiveness and increased utilization of Western Fossil Energy Resources. In the sections that follow, brief descriptions are provided of background issues and how the meeting was conducted. Subsequent chapters of this report present the discussions that ensued at the meeting, and the views, recommendations, and concerns that were expressed by attendees. Finally, the report includes a summary of the written comments that were received, and an appendix which contains a list of the organizations that were represented at the public meeting.

5271 Energy in Illinois and the Midwest: The changing economic and regulatory scene. 187p. Illinois Dept. of Energy and Natural Resources, Springfield, IL (1987). (CONF-8610132–: 14. annual Illinois energy conference: energy in Illinois and the Midwest - the changing economic and regulatory scene, Chicago, IL (USA), 30-31 Oct 1986).

This book collects papers given at an energy conference partially sponsored by the US DOE. Topics include: world oil prices, the future role of nuclear power, impact of market forces and contract carriage on the natural gas sector, the electric utilities, and energy planning in Illinois and the Midwest.

5272 Western inflation and oil prices from the shocks to the big recovery. Lutfalla, M. *Revue de l'Energie (France),* 40(413): 621-632 (Aug-Sep 1989).

The role of the two oil shocks, the one in 1973 and the one in 1979, in the big inflation and in the crisis of the years 1973-1983, have often been described. Just the same, it does not seem that we have always taken care that these shocks, late in economic evolution, did not occur in an economical void and under the sole influence of a political event. Activity then inflation accelerated in the West well before the action of the oil exporting countries. Two sequencies had to come together, one economic, the other political, in order that tensions between hydrocarbon supply and demand would lead to an explosion of their prices. In the spring of 1989, after many more or less lean years, at a moment when growth is rapid again, carrying along in its wake tensions in capacity utilization, and when oil prices have been substantially rectified, it might well be useful to revisit the two recent precedents in this field, i.e. 1971 - 73 and 1979. From a parallel with the situations prevalent at that time, certain conclusions will be drawn for the present period of great recovery.

5273 World gas markets: expansion and mutation. Valais, M. (Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison). *Revue de l'Energie (France),* 40(413): 753-771 (Aug-Sep 1989).

If we take the early 1960s as the starting point of the worldwide development of natural gas, the impression derived at a distance of some thirty years is that of strikingly steady expansion. This means the quantitative expansion of reserves, of production, of consumption and of gas trade, and also the geographic expansion of discoveries, of transport networks and of international trade flows. The last two decades, rich as they have been in political, economic and energy events of all varieties, could have marked the gas industry as deeply as they did the oil industry. Yet this did not happen. The gas industry has not experienced a complete worldwide recession. Its expansion, momentarily held back by the general economic situation, has resumed on all markets. A projection to twenty or forty years from today does not appear to disturb significantly this reasonably optimistic assessment of expansion and continuity. Certainly, the growth of the production and world consumption of natural gas entered a phase of very progressive slowdown since the mid-1970s. However, the expansion of the gas industry is nowhere near its limits. It will probably not be before the middle of the next century that world natural gas supply will have reached a plateau.

5274 The international steam coal market: coming into maturity. Giraud, P.N. (Paris-9 Univ., 75 (FR)). *Revue de l'Energie (France),* 40(413): 741-752 (Aug-Sep 1989).

This article outlines the history of the development of international trade in steam coal and of the new industry made possible in this way. It first of all examines the development of international flows, then the development of the industrial and commercial participants. Finally, it proposes an interpretation of the present logic of the formation of steam coal prices and the limits to their fluctuations. After a youth featuring brisk and tumultuous growth, it leads to the assumption by this industry of a phase of maturity and greater price stability.

5275 Opec's challenge: how to manage the surplus. Ayoub, A. (Laval Univ., Quebec City (CA)). *Revue de l'Energie (France),* 40(413): 732-740 (Aug-Sep 1989).

Will oil demand increase. Will supply be sufficient. Will OPEC survive. If it does, through what means and for how long. How will the market be split between OPEC and non OPEC countries. Will the downstream integration of some producing countries really have a profound effect on market structures. Where is the price of oil headed and what of influence will its movement have on alternate sources of energy. The intention here, of course, is not to propose clearcut categorical responses to questions as complex and entangled as these. The most we can do is examine the multiple factors that influence them and extract the common point from which they may be approached, namely, the oil surplus phenomenon that began in 1980 which is so large today that it directly determines the evolution of the market as well as the behaviour of the principal players (OPEC, non-OPEC, and oil companies).

5276 Forty years of energy. Desprairies, P. (Institut Francais du Petrole (IFP), 92 - Rueil-Malmaison). *Revue de l'Energie (France),* 40(413): 871-879 (Aug-Sep 1989).

It takes an effort to remember the outlook that existed after the second world war concerning energy and its environment. During the last forty years, one event dominated the history of the world energy industry, that was the start-up of production from the giant oil fields in the middle East, discovered between the two wars, but mainly developed after 1950. The next eight years (1974-1981) saw the complete reversal of the world situation, the oligarchy of the companies gave way to an oligarchy of producing countries groups together in OPEC. The 1980s have seen the blossoming of the consequences from the shakeout of too high prices and the nationalization of fields.

2960 Electric Power

Refer also to citation(s) 4977, 5265, 5269, 5286

5277 (HQ–89-03180) **Electricity demand in Quebec. 2006 outlook.** Hydro-Quebec, Montreal, PQ (Canada). Mar 1989. 100p. (MICROLOG–89-03180). Available from PC Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, CAN H2Z 1A4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This report supplements the Hydro Quebec Development Plan 1989-1991; 1998 Outlook. It presents the assumptions and results of the target scenario of the regular demand of electricity in Quebec until the outlook 2006. This scenario is the basis of the long-term planning of Hydro Quebec; it reflects the objectives of the corporation to maintain and improve the use of oil and electricity bi-energy heating, in the residential sector, to adopt and increase interruptible power supplies, and, simultaneously, to adopt the rate structure so as to orient its clients towards a more convenient use of electricity. So as to take uncertainties into account, the target scenario is accompanied by strong and weak electricity demand scenarios which include the effects of different demographic and economic contexts. The report deals with regular electricity sales in Quebec, supplementary electricity sales in Quebec, the energetic balance of the province, energy conservation and substitution, the economical and energetic context, and the various economic sectors. A table in Appendix 6 shows the demand of electricity in Quebec throughout the period 1966-1987. 1 ref., 4 figs., 60 tabs.

5278 (HQ–D89-0001) **Hydro-Quebec development plan, 1989-1991. 1998 outlook.** Hydro-Quebec, Montreal, PQ (Canada). Mar 1989. 174p. (MICROLOG–89-03174). Available from PC Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, CAN H2Z 1A4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The development plan of Hydro Quebec is aimed at the managers and employees so as to guide their action at the partners of the Corporation so as to optimize the advantages of hydro-electrical power. The plan covers a 10-year span and presents a forecast of the financial framework for the next 3 years. The subjects covered are the economic and energetic context, the Quebec and external markets, the operation of the installations, the supply and demand of electric power, the objectives and strategies for building new equipment, technological and international affairs, human resource management, financial management, and the economic impact of the activities of Hydro Quebec on the economy of the province. 32 figs., 37 tabs.

5279 (HQ–D89-0011) **Hydro-Quebec development plan, 1989-1991. 1998 outlook: Synthesis document.** Transport Canada, Ottawa, ON (Canada). Urban Transportation Research Branch. Mar 1989. 28p. (MICROLOG–89-03175). Available from PC Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, CAN H2Z 1A4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This report is based on the development plan of Hydro Quebec for 1989-1991 outlook 1998. It deals with the economic environment, supply and demand of electric power (the hydroelectric potential being considered at present is 17.96 GW and could provide 95.1 TWh yearly), service quality, personnel management, financing and rates, the economic impact of the activities of Hydro Quebec (in 1989-1991, the external employment supported by the Corporation will increase by 15,000 people x year), and the protection of the environment. In conclusion, 1989 marks the beginning of new building works; the objectives of the Corporation are to increase its adaptability to possible demand scenarios, to improve service quality and to serve the social and environmental objectives of the Province of Quebec. 1 fig., 10 tabs.

5280 (PB–89-219604/XAB) **Feasibility of conducting an electricity real-time pricing experiment in maryland. Research report 15 June 1987-30 November 1989.** Caves, D.W.; Kirsch, L.D.; Reddoch, T.W. Christensen (Laurits R.) Associates, Inc., Madison, WI (USA). May 1989. 191p. Available from NTIS, PC A09/MF A01.

Under 'real-time pricing' (RTP) of electricity, utilities frequently change their prices in response to changes in power-system conditions. With RTP, utilities can use price signals to implicitly inform both their customers and independent power producers about current cost, operating, and reliability conditions of their power systems. The report has two objectives: first, to provide information indicating the economic feasibility of RTP in Maryland; and second, to specify the most promising approaches for implementing RTP on an experimental basis in Maryland. Consequently, the report reviews the economic literature related to RTP, surveys existing RTP programs, presents a preliminary design and analysis for an RTP program that could be offered to a group of Baltimore Gas and Electric Company curtailable customers, and assesses the institutional concerns that may be raised by RTP.

5281 (PB–89-233563/XAB) **Empirical analysis of electricity wheeling in Illinois.** Jensen, V.; Scott, M. Lotus Consulting, Los Altos, CA (USA). Jan 1988. 32p. Available from NTIS, PC A03/MF A01.

This report examines in detail the potential effect of wheeling on electrical rates for all customers. Empirical estimates of the costs of increasing levels of wheeling were prepared using a detailed model of electric utility production and finance. Scenarios were constructed for Commonwealth Edison and Illinois Power Companies. Results of the analysis show that moderate amounts of bypass for Commonwealth Edison (150 to 1000 MW), produce increases in average costs between 0.8% and 10.8%. For Illinois Power, wheeling levels of between 75 to 300 MW, produce increases between 3 and 14%. The results of the analysis suggest that the costs of bypass are closely linked to the capacity situation of the affected utility at the time wheeling takes place. Estimates were prepared of the secondary economic impacts of bypass. Losses in employment and personal income could be expected if rates were raised to 'reimburse' utilities for revenue losses. These losses would amount to less than one-half of one percent of total employment, personal income, and Gross State Product.

5282 (PNL–7173) **Peak load management: Potential options.** Englin, J.E.; De Steese, J.G.; Schultz, R.W.; Kellogg, M.A. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 44p. Sponsored by U.S. DOE Management & Administration. DOE Contract AC06-76RL01830. Order Number DE90003164. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report reviews options that may be alternatives to transmission construction (ATT) applicable both generally and at specific locations in the service area of the Bonneville Power Administration (BPA). Some of these options have potential as specific alternatives to the Shelton-Fairmount 230-kV Reinforcement Project, which is the focus of this study. A listing of 31 peak load management (PLM) options is included. Estimated costs and normalized hourly load shapes, corresponding to the respective base load and controlled load cases, are considered for 15 of the above options. A summary page is presented for each of these options, grouped with respect to its applicability in the residential, commercial, industrial, and agricultural sectors. The report contains comments on PLM measures for which load shape management characteristics are not yet available. These comments address the potential relevance of the options and the possible difficulty that may be encountered in characterizing their value should be of interest in this investigation. The report also identifies options that could improve the efficiency of the

three customer utility distribution systems supplied by the Shelton-Fairmount Reinforcement Project. Potential cogeneration options in the Olympic Peninsula are also discussed. These discussions focus on the options that appear to be most promising on the Olympic Peninsula. Finally, a short list of options is recommended for investigation in the next phase of this study. 9 refs., 24 tabs.

5283 (YG/BS–89-03864) **Yukon energy statistics: A research paper.** Yukon Government, Whitehorse, YU (Canada). Bureau of Statistics. Dec 1988. 67p. (MICROLOG–89-03864). Available from PC Yukon Territory. Bureau of Statistics, PO Box 2703, Whitehorse, YU, CAN Y1A 2C6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

This paper presents data on electicity and petroleum products in the Yukon Territory, derived from sources including the Yukon government, the National Energy Board, Statistics Canada, and private and public companies. Data presented are the most recent available as of October 1988. Data on electricity include plant operations, peak load, transmission circuit length, sales customers, assets and liabilities of electric utility companies, generation of electricity, consumption by sector, electricity bills, and electricity cost by quarter. Data on petroleum products includes product sales by quarter and mont , sales of motor gasoline, motor vehicles, urban transit statistics, pipeline transport, and fuel oil, gasoline and diesel prices. Most data is given for the 1980s, with some earlier figures. 36 tabs.

2980 Consumption and Utilization

Refer also to citation(s) 5269

5284 (LBL–26946) **Regional electricity supply and consumption in developing countries, 1980–1986: Database report: Draft.** Meyers, S.; Campbell, C. Lawrence Berkeley Lab., CA (USA). Mar 1989. 35p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC03-76SF00098. Order Number DE90002615. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We describe the main statistics from a database on electricity supply and consumption by region for the developing countries for the period 1980–1986. The regions covered are Northeast Asia, Southeast Asia, South Asia, Middle East & North Africa, Sub-Saharan Africa, and Latin America & Caribbean. The variables in the database are population; installed generating capacity, disaggregated by plant type into thermal, hydro, and nuclear; electricity generation, disaggregated by source into coal, oil, gas, hydro, and nuclear; and electricity consumption, disaggregated by sector into industry, residential, commercial, transportation, agriculture. The database is presented at the end of the report.

2990 Unconventional Sources and Power Generation

Refer also to citation(s) 4968, 5110

5285 (NEDOJ-P–8828) **Investigation on the optimum form of introducing dispersed new power sources (Part 3).** New Energy Development Organization, Tokyo (Japan). Mar 1989. 110p. (In Japanese). Order Number DE90725120. Available from NTIS (US Sales Only), PC A06.

In the Japanese electric power system, scale merits have been pursued in the form of regional monopoly by a general electric utility. With the development of new energies, however, fuel cells, photovoltaic, and wind power generation have come to be put to practical use. And making the most of their cleanness and their flexibility in scales, small-scale dispersed power sources near the places of demands are going to be brought into being. Under this situation, Mitsubishi Research Institute Inc., entrusted by New Energy Development Organization, conducted an investigation on the problems of small-scale dispersed power sources. In the fiscal 1986 and 1987, the influences dispersed new power sources exert under the present energy supply and demand system were studied. As a result, it was found out that dispersed new power sources have come to be much expected because competitions among energies are becoming more intensified, the scale merits of electricity utilities are being reduced, environmental problems are becoming more critical, demands for energy are becoming diversified and independent, and because the use of power on site in accordance with the needs has become prevalent. 14 figs., 25 tabs.

30 DIRECT ENERGY CONVERSION

5286 (PB–89-231567/XAB) **Semiannual compilation of Project Briefs, August 1989 (Power Information Center).** CSR, Inc., Washington, DC (USA). Power Information Center. Aug 1989. 74p. Available from NTIS, PC A04/MF A01.

See also PB–89-158802.

The Semiannual Compilation of Project Briefs represents a listing of the projects maintained in the Power Information Center automated data base from August 1986 to July 1987. The information is presented in two separate categories. Part I is a listing by field of interest of the IAPG project briefs that were active or completed during this time. The fields of interest are chemical, electrical, magnetohydrodynamics, mechanical, nuclear, solar, and systems energy research. The listing is arranged alphabetically within each field of interest and gives the brief number, title of the project, project manager, directing agency codes, research facility, funding information, and current status.

3001 MHD Generators

5287 (DOE/ID/12735–T4) **[Manage, operate and maintain the component development and integration facility in Butte, MT]: Quarterly technical progress report, July 1–September 30, 1989.** MSE, Inc., Butte, MT (USA). [1989]. 18p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC07-88ID12735. Order Number DE90003701. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Component Development and Integration Facility (CDIF) is a major US Department of Energy magnetohydrodynamic (MHD) test facility in Butte, Montana. The CDIF is operated by MSE, Inc. Within the national MHD program, MSE personnel are responsible for performing integration testing of vendor-supplied MHD power train components at the CDIF to support the goal of commercialization. During the fourth quarter of FY89, installation of channel $1A_1$-C1 and AVCO-supplied current consolidation circuits was completed. Equipment checkout was also completed. Baseline testing with a new oxygen configuration was started, and iron oxide injection on cathode and anode walls was evaluated. Mississippi State University measurements were taken at the diffuser triple port walls. 2 tabs.

3002 EHD Generators

5288 (CRIE-T–88012) **Survey on application of electrohydro-dynamics (EHD).** Sunaga, Yoshitaka; Watanabe, Tsuneo. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Dec 1988. 72p. (In Japanese). Order Number DE90725013. Available from NTIS (US Sales Only), PC A04/MF A01.

This paper reports the present status of studies on application of Electrohydro-dynamics (EHD), especially on EFD power generation and augmentation of heat transfer by EHD techniques. Further subjects to be studied are shown and some new systems or techniques on the application are proposed. Several systems of EFD power generation using combustion gas and EFD wind driven generator have seen studied, but no system is in practical application. In this paper, a new method of wind driven generator using charged jet droplets generated from bubbles is proposed. Application of EHD techniques to heat transfer augmentation has been studied in several fields such as cooling of power cables, cooling of electric devices or machines, EHD heat pipes, and high-efficiency condensation heat exchanger. Studies on the EHD heat exchanger are in the stage of practical application. Many problems are remained unsolved for the other application fields. Arrangements of EHD electrodes for pumping oil in power cables are shown, and new types of EHD heat pipes are proposed in this paper. 88 refs., 38 figs., 14 tabs.

3004 Thermionic Converters

5289 (CONF-8910301–1) **Development of a diamond insulator for thermionic applications.** Purohit, A. (Argonne National Lab., IL (USA)); Bhattacharyya, S.K.; Vandersande, J.; Wood, C.; Kennel, E. Argonne National Lab., IL (USA). [1989]. 36p. Sponsored by U.S. Department of Defense; U.S. DOE Defense Programs. DOE Contract W-31109-ENG-38. From 1989 thermionic conversion specialists conference; Eindhoven (Netherlands); 9-12 Oct 1989. Order Number DE90002849. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Diamond (D) and Diamond Like Carbon (DLC) films and thick sections are being considered for several applications, one of which is as electrical insulators for the converter of the in-core thermionic generator. The purpose of our work is to: (1) optimize several methods of D & DLC depositions, (2) characterize the thermomechanical, optical and electrical properties at room and elevated temperatures, and (3) determine the effects of fast neutron and gamma irradiation on the structure and properties of these films. D and DLC films using a variety of H_2/CH_4 gas mixtures, have been deposited on silicon and niobium substrates, using four different deposition techniques. The resultant films have been examined using optical and scanning electron microscopy and Raman spectroscopy. 5 refs., 22 figs.

3005 Fuel Cells

Refer also to citation(s) 5224, 5285

5290 (AD-A–211386/8/XAB) **Long endurance underwater power system. Quarterly report, April-June 1989.** Aquanautics Corp., Alameda, CA (USA). 4 Aug 1989. 62p. Available from NTIS, PC A04/MF A01.

As part of DARPA's 'Artificial Gill' program, Aquanautics is developing an underwater power source that uses an ambient-pressure solid-polymer-electrolyte (SPE) hydrogen/oxygen fuel cell with an artificial gill that extracts dissolved oxygen from seawater and an Alwatt aluminum corrosion cell that generates the hydrogen. The innovation in this concept is a direct-carrier-feed fuel-cell (CFFC) process that allows the fuel cell to operate at ambient pressure without a costly deep water pressure vessel. Activities during this quarter include: (1) Direct feed of oxygen carrier into fuel cell. New batches of electrodes have been ordered. These are with a different ion-exchange membrane called Nafion (manufactured by Dupont) as against Raipore (mfd. by RAI Research). There was some concern that hydrogen at high pressures would leak out through the membrane which led us to calculate the hydrogen leakage; it appears that at 6000 m, the loss will be around 20%. (2) Gill. Eight rectangular membrane cartridges were ordered. The factors varied were type of membrane (solid vs. microporous) and fiber-to-fiber distance. Theoretical study for sizing of the gill and pumping power required was carried out. (3) Integration of the gill and fuel cell was carried out where oxygen extracted from synthetic ocean water was used in the fuel cell. There was no unforeseen problem. (4) Hydrogen generation. An Alwatt battery was obtained and tested. Testing indicated that the Alwatt battery will produce the expected power and hydrogen for the CFFC process.

5291 (AD-A–211542/6/XAB) **Lightweight solid-polymer-electrolyte fuel cell with stack power density of 3kW/lb (7 kw/kg).** Appleby, A.J. Texas A and M Univ., College Station, TX (USA). Center for Electrochemical Systems and Hydrogen Research. 1989. 10p. Available from NTIS, PC A02/MF A01.

Publications/Patents/Representations/Honors/Students Report.

The objectives of the solid-polymer-electrolyte fuel-cell project are: (I) Investigations of physico-chemical properties of various solid-polymer electrolyte electrode kinetics at Pt/solid-polymer electrolyte interfaces. (II) Optimization of low and high Pt-loading gas-diffusion electrode conditions, structures, membrane bonding to obtain most effective electrocatalyst membrane interface and hence attain maximum fuel-cell performance. (III) Mathematical modeling of electrochemical, mass-transfer, and heat generation characteristics associated with cell operation to optimize fuel-cell thermal and water management.

5292 (AD-A–211644/0/XAB) **Mechanism of electrochemical activation of carbon electrodes: Role of graphite lattice defects.** Bowling, R.J.; Packard, R.T.; McCreery, R.L. Ohio State Univ., Columbus, OH (USA). Dept. of Chemistry. 1989. 7p. Available from NTIS, PC A02/MF A01.

Pub. in Langmuir, Vol. 5, No. 3, 683-688(1989).

By use of Raman spectroscopy as a probe, the relationship between carbon microstructure and increases in the heterogeneous electron-transfer rate for carbon electrodes was examined. A distinctive Raman band at 1360/cm is proportional to the density of graphitic edge planes and may be used to monitor changes in edge plane density induced by carbon pretreatment procedures. It was shown that electrochemical oxidation of highly ordered pyrolytic graphite (HOPG) caused fracturing of the graphite lattice, thus increasing edge plane density. This result is consistent with other reports from laser activation of HOPG, which correlate increased edge plane density with increased electron-transfer rate. Creation of edge plane is a phenomenon common to both oxidative and nonoxidative activation procedures and is responsible for HOPG activation. Arguments about the involvement of graphitic oxide or oxygen containing functional groups in electron-transfer activation are presented. After the present results are combined with those from the literature, it appears unlikely the oxygen functional groups are involved in electron-transfer activation of several benchmark redox systems on carbon electrodes.

5293 (AD-A–211645/7/XAB) **Activation of highly ordered pyrolytic graphite for heterogeneous electron transfer: Relationship between electrochemical performance and carbon microstructure.** Bowling, R.J.; Packard, R.T.; McCreery, R.L. Ohio State Univ., Columbus, OH (USA). Dept. of Chemistry. 1989. 8p. Available from NTIS, PC A02/MF A01.

Pub. in Jnl. of the American Chemical Society, Vol. 111, No. 4 p1217-1223(1989).

The electrochemical and vibrational spectroscopic properties of highly ordered pyrolytic graphite (HOPG) were determined before and after modification by anodization or pulsed laser irradiation. Both treatments greatly accelerated the heterogeneous electron-transfer-rate constants for the Fe(CN)6(3-/4-) and dopamine redox systems on HOPG by approximately six orders of magnitude. At intermediate electrochemical pretreatment (ECP) potentials, a spatially heterogeneous surface resulted, with surface regions exhibiting the 1360/cm band being separated by tens of microns. The results clearly indicate that graphitic edge plane is necessary for fast electron transfer, and that the pretreatment procedures accelerate k0 by generating edge-plane defects in the HOPG lattice. The mechanisms of defect generation for the two procedures appear very different, with ECP appearing to follow a nucleation process leading to a spatially heterogeneous surface, while the laser pulse appears to shatter the HOPG lattice, leading to a more uniform distribution of active sites. The results provide important conclusions about the relationship between carbon electrode microstructure and heterogeneous electron transfer activity. Of particular interest is the heterogeneous electron transfer rate between carbon electrodes and various well-known redox systems such as ascorbic acid, ferri/ferrocyanide, and the catecholamines. Not only are these systems of significant analytical interest, but they serve as benchmarks for comparisons of electrode performance.

5294 (CONF-891113–8) **Fabrication of porous ceramic electrode structures.** Kucera, G.H.; Smith, J.L.; Brown, A.P. Argonne National Lab., IL (USA). [1989]. 10p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. From American Institute of Chemical Engineers annual meeting; San Francisco, CA (USA); 5-10 Nov 1989. Order Number DE90003548. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The conventional cathode material in molten carbonate fuel cells, NiO, has a limited lifetime due to dissolution under cathodic conditions and precipitation as the metal under anodic conditions. Alternative ceramic materials, identified as stable in the cathode environment, have been made electronically conductive through doping. Techniques to fabricate dual-porosity electrodes from these alternative ceramic materials have been developed and are

reported. Cell tests, using NiO cathodes, have ascertained the viability of the new techniques for obtaining the desired electrode structure; these data are also presented. 8 refs., 4 figs.

5295 (CONF-891113–9) **Characterization of new cathode materials for molten carbonate fuel cells.** Brown, A.P.; Smith, J.L.; Kucera, G.H. Argonne National Lab., IL (USA). [1989]. 8p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. From American Institute of Chemical Engineers annual meeting; San Francisco, CA (USA); 5-10 Nov 1989. Order Number DE90003547. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The in-cell performance is reported for molten carbonate fuel cell cathodes fabricated from fibrous agglomerates of $LiFeO_2$. Both 25 cm^2 full-cell tests with an Ni-Cr anode and half-cell tests with a gold reference electrode are described. Cathode materials tested were undoped $LiFeO_2$ and $LiFeO_2$ doped with Cu, Co, or Mn. Parameters varied included the electrode pore structure and the size of the particles forming the agglomerates. These tests demonstrated that the $LiFeO_2$ cathodes are morphologically and chemically stable; these cathodes do not suffer from the dissolution/reprecipitation problem that limits the long-term performance of conventional NiO cathodes. The $LiFeO_2$ cathodes, however, have not yet achieved state-of-the-art performance. They currently have an electron-transfer-limited reaction rate and a high iR drop. Methods are discussed for improving the cathode performance by, for example, modifying the electrode structure to reduce the porosity. 8 refs., 7 figs., 1 tab.

5296 (DOE/PC/79931–T4) **Oxygen electrode in molten carbonate fuel cells: Seventh quarterly technical progress report, February 1, 1989–April 30, 1989.** Dave, B.B. (Texas A and M Univ., College Station, TX (USA). Dept. of Chemical Engineering); Adanuvor, P.K.; Enayetullah, M.A.; White, R.E.; Srinivasan, S.; Appleby, A.J. Texas A and M Univ., College Station, TX (USA). Center for Electrochemical Systems and Hydrogen Research. [1989]. 24p. Sponsored by U.S. DOE Fossil Energy. DOE Contract FG22-87PC79931. Order Number DE90002871. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Effects of partial pressure of oxygen and temperature on oxygen reduction kinetics on a submerged gold electrode in lithium carbonate melt were investigated using cyclic voltammetry and impedance analysis. Cyclic voltammetry measurements show that the peroxide reduction reaction in Li_2CO_3 melt is reversible up to 200 mV/s. The impedance analysis was carried out using a Complex Nonlinear Least Square (CNLS) parameter estimation program based upon the Randles-Ershler equivalent circuit. This analysis estimated electrode kinetics and mass transfer related parameters such as charge transfer resistance and Warburg coefficient. The mass transfer related parameters obtained from cyclic voltammetry and impedance analysis show good agreement. The oxygen reaction orders for mass transfer parameter and exchange current density at 800°C were calculated to be 0.5 and 0.377 respectively; these values are consistent with the peroxide mechanism. 9 refs., 13 figs., 3 tabs.

32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

Refer also to citation(s) 5237

3201 Buildings

Refer also to citation(s) 4641, 4925, 4936, 4937, 4938, 4939, 4940, 4941, 4942, 4943, 4944, 4945, 4946, 4947, 4948, 4949, 4950, 4951, 4952, 4953, 4956, 5222, 5223, 5255, 5256, 5354, 5818

5297 (AEC–8110/1) **Oil/electric hybrid heating experiment and demonstration: Part 1. Executive summary.** Elliott, R.K. (Atome Energy of Canada Ltd., Chalk River, ON (Canada)). Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs. 1983. 11p. (CE–02766). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: $0.34 CAN per page, $3.40 minimum.

Oil/electric heating systems and energy measuring instrumentation were installed in 50 Atomic Energy of Canada Ltd.-owned rental houses in Deep River. These were operated and monitored for two heating seasons to demonstrate their performance and determine the percentage oil displacement as a function of heater capacity and control system. All experimental data was stored and processed by computer. Oil furnace utilization efficiency varied from 48 to 59% for an average of 53.5%; oil displacement ranged from 49 to 83% for 2.5 and 5.0 kW electric heaters controlled by two-stage indoor thermostats. Fuel costs for oil/electric hybrid heating, with 5.0 kW plenum heaters and indoor two-stage thermostats, were 20% less than for oil heating, based on average furnace efficiency and 1983 January retail fuel prices. Annual load factors above 37% were achieved for plenum heaters compared to 11.9% for all-electric systems. Space heating requirements were proportional to heating degree days calculated with a balance temperature of 14°C rather than standard 18°C; and conventional heat loss calculating methods yield results that are at least 80% higher than experimental results. This report describes background information, the heating equipment and instrumentation, data processing, and results. Appendices 2 and 3 include graphs of experimental data on which the conclusions are based. The report also describes dissemination of information, other multi-source heating and cooling systems, and the use of interruptible power to promote widespread application of hybrid heating. 1 fig., 1 tab.

5298 (AMA–89-02696) **Structural testing of the NASCOR II R20 wall system for United States product acceptance.** Alberta Municipal Affairs, Edmonton, AB (Canada). Innovative Housing Grants Program. 1988. 105p. (MICROLOG–89-02696). Available from PC Alberta Legislative Library, 216 Legislature Bldg., Edmonton, AB, CAN T5K 2B6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Cano Structures has been successfully producing the NASCOR II R20 wall system in Canada for four years and, to date, about 6000 units have been constructed. In order to enter the U.S. market, the wall system had to be evaluated by U.S. building code authorities to determine its compliance with their building code. The International Conference of Building Officials (ICBO) was the authority chosen to conduct the evaluation. Assistance was sought under the Innovative Housing Grants Program to conduct structural testing in accordance with ICBO criteria and to have ICBO perform an evaluation that results in a formal acceptance of the wall system. The testing program consisted of subjecting wall panels to tests of axial load, transverse load, and racking load. In addition, the 76 mm wood screws used in the NASCOR wall system were tested for shear and pull-out values, and the adhesive used by Cano Structures in Canada was compared in shear tests to the urethane adhesive proposed for use in the U.S. Test results were used to develop empirical formulae and allowable load tables (axial and transverse). Test results and ICBO evaluation showed that the NASCOR II R20 wall system complies with the Uniform Building Code. ICBO therefore formally accepted the wall system. 5 figs.

5299 (AMA–89-02699) **Development of the 7S-3000 stressed skin panel building system.** Alberta Municipal Affairs, Edmonton, AB (Canada). Innovative Housing Grants Program. 1988. 177p. (MICROLOG–89-02699). Available from PC Alberta Legislative Library, 216 Legislature Bldg., Edmonton, AB, CAN T5K 2B6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This report outlines a test program undertaken to qualify 7S-3000 Stressed Skin Panel System to Canada Mortgage and Housing Corporation (CMHC) and Alberta Building Standards (ABC) requirements. The 7S-3000 system is a load-bearing panel having continuous header, base, and top and bottom plates filled with polyurethane insulation. It provides a fast, precise method for constructing energy efficient houses and small buildings. The report also gives some of the background of the development of the 7S-3000 stressed skin panels for structural components including walls, floors, and roofs, and discusses the potential uses for the panels. Structural, thermal, and various other tests have demonstrated that these stressed skin panels may be used in residential and light commercial construction. Applications for product approval have

been made to CMHC, the International Conference of Building Officials (ICBO) in the U.S., and various other agencies. It appears that formal approvals allowing general use of the 7S-3000 panels will be forthcoming. Various prototype structures including three residences, three farm buildings, and one light commercial project have been completed to date. Invaluable experience has been gained with these prototypes regarding improved fabrication and field erection procedures. A pilot plant located in Grande Prairie (Alberta) is the only production facility in place to date, and is capable of producing 90 m of wall panels per shift. This plant's production procedures and quality control procedures are being audited. A business and marketing plan to promote the use of the panels is outlined. 47 figs., 9 tabs.

5300 (CONF-891096–1-Vugraphs) **Motor current signature analysis: A potential diagnosis for air conditioners.** Mixon, W.R. Oak Ridge National Lab., TN (USA). [1989]. 21p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From Building retrofit innovative concepts fair; Washington, DC (USA); 24 Oct 1989. Order Number DE90002499. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper presents methods and equipment for use in the testing of air conditioners. (FSD)

5301 (CONF-891202–1) **Model for the thermal performance of low-sloped roofs.** Wilkes, K.E. Oak Ridge National Lab., TN (USA). [1989]. 28p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From 4. thermal performance of the exterior envelopes of buildings; Orlando, FL (USA); 4-7 Dec 1989. Order Number DE89016072. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper gives a detailed description of the model named STAR (for Simplified Transient Analysis of Roofs) that has been developed at ORNL for predicting the heat flows and temperatures within roof systems. STAR is a one-dimensional, finite-difference, transient heat conduction model that can be used on a personal computer. It has full coupling to the ambient weather conditions, but can also be used with specified temperature boundary conditions. The paper also gives results of a validation study in which predictions of the model were compared with temperatures and heat flows that were measured on roof sections at ORNL's outdoor Roof Thermal Research Apparatus. Finally, the paper gives several examples of the application of the model in performing parametric analyses of the thermal performance of roofs. The model is used to predict membrane temperatures and roof heat flows as influenced by variations in parameters such as level of insulation, amount of surface mass, and solar absorptance of the roof surface. 7 refs., 10 figs., 4 tabs.

5302 (CONF-891202–2) **Thermal modeling of residential attics with radiant barriers: Comparison with laboratory and field data.** Wilkes, K.E. Oak Ridge National Lab., TN (USA). [1989]. 32p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From 4. thermal performance of the exterior envelopes of buildings; Orlando, FL (USA); 4-7 Dec 1989. Order Number DE89016287. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Radiant barriers (RBs) are receiving increasing attention as an energy conservation measure. A number of experiments that have been performed by several organizations have demonstrated the energy savings potential for RBs. The experiments have utilized a number of different attic and RB configurations and have been conducted under differing weather conditions. Because of this, it is difficult to intercompare the experimental results. Models are needed to gain a better understanding of the performance of radiant barriers, to extrapolate experimental data to seasonal and annual performances, and to estimate the performance under other climatic conditions. This paper describes models that have been developed at ORNL for residential attics, with or without radiant barriers. Models based on systems of heat balances have been developed for both horizontal RBs that are laid on top of the attic insulation, and for radiant barriers attached to the bottom of the top chords of attic trusses. The models include features such as radiation interchanges within the space, convection to ventilation air, and sorption/desorption of moisture at surfaces facing the attic space. The paper gives comparisons of model predictions with data from steady-state laboratory experiments and from field experiments with full-size houses. 19 refs., 8 figs., 5 tabs.

5303 (CONF-891202–3) **Work sheet for selection of optimal foundation insulation.** Christian, J.E. Oak Ridge National Lab., TN (USA). [1989]. 20p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From 4. thermal performance of the exterior envelopes of buildings; Orlando, FL (USA); 4-7 Dec 1989. Order Number DE89015979. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A work sheet has been developed which can help a residential builder select the optimal level of foundation insulation for new or retrofit construction based on user-specified conditions. The work sheet solicits site-specific input from the user and supplementary look-up tables. The input is used in a series of simple mathematical equations leading to the identification of the most cost-effective solution from a list of user specified options. The climate is specified by heating degree day base of 65°F and cooling degree hour base of 74°F. The energy savings of various foundation insulation configurations are determined from heating and cooling load factors derived from linear regression analysis of the computer simulation data base described in the Building Foundation Design Handbook. Local energy prices are requested, and the user can choose from three different economic decision criteria: 20-year minimum life cycle cost (suggested for retrofit); 30-year minimum life cycle cost; and second year positive cash flow (suggested by National Association of Home Builders National Research Center). A set of work sheet instructions guides the user step-by-step through the fill-in-the-blank work sheet. 4 refs., 6 figs., 8 tabs.

5304 (CONF-891202–4) **Measured effects of zoning in single-family houses.** Levins, W.P. Oak Ridge National Lab., TN (USA). [1989]. 16p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From 4. thermal performance of the exterior envelopes of buildings; Orlando, FL (USA); 4-7 Dec 1989. Order Number DE90000563. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The zoning of sections of a house by closing doors and air supply and return registers in certain rooms is a practice usually thought to conserve energy in households. Previously reported measurements of energy required for resistance heating and heat pump heating made by the author in three unoccupied, well-instrumented, single-family, ranch-style houses in Knoxville, TN, showed that heat pump heating savings were somewhat lower than resistance heating savings. Measurements of heat pump cooling energy usage as well as actual sensible and latent loads were made in the same houses. Temperatures in closed-off rooms floated with the outdoor temperature variations, but no savings were observed in the overall heat pump electrical usage or in the house cooling load. Measurements made on the heat pump operating parameters showed minor effects on airflows and refrigerant operating pressures until about 40% of the houses area was zoned off. Formaldehyde measurement in zoned-off rooms were also made during cooling season operation and they did not differ appreciably from those levels in the non-zoned portion of the house. 4 refs., 5 figs., 8 tabs.

5305 (CONF-891208–14) **System design and performance prediction of a free-piston Stirling engine/magnetic coupling/compressor assembly in a gas residential heat pump.** Chen, G.; Beale, W.T. Sunpower, Inc., Athens, OH (USA). 1989. 18p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From Winter annual meeting of the American Society of Mechanical Engineers; San Francisco, CA (USA); 10-15 Dec 1989. Order Number DE89016070. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Based on the previous evaluation of a magnetic coupling and the described system-design targets, a gas-fired free-piston Stirling engine/magnetic coupling/compressor (FPSE/MC/C) assembly as a power module for a residential heat pump application has been designed and analyzed. A porous combustor/FPSE/magnetic coupling/variable-gas control spring/reciprocating compressor assembly was the design selected and reported in this paper. Based on the system characteristics, design efforts are described on the following issues: one, design of a combustor allowing low pressure of natural-gas supply; two, the means to achieve engine power-load matching; three, the method to maintain the assembly as a resonant system

tuning over a wide range of operating conditions; four, the design of an engine/coupling structure to minimize the magnet mass without sacrificing its mechanical properties; and five, compressor load-capacity modulation. The system analysis and the system performance, which is analytically predicted and described in this paper, indicate all the system design goals can be met leading to a strong recommendation for further development. 9 refs., 10 figs., 5 tabs.

5306 (CONF-891208–19) **Heat transfer of buried pipe for heat pump application.** Mei, V.C. (Oak Ridge National Lab., TN (USA)). Oak Ridge National Lab., TN (USA). Jul 1989. 8p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. From Winter annual meeting of the American Society of Mechanical Engineers; San Francisco, CA (USA); 10-15 Dec 1989. Order Number DE90000580. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Ground coil heat pump systems are well known for their potential of energy conservation. The majority of the ground coil designs were based on the application of the line source theory. A modified line source method was later derived to calculate the ground temperature distribution by dividing the ground around the coil into "blocks." However, the line source approach has some major drawbacks, which often leads to the over-design of the ground coil. It was anticipated that in order for the ground coil heat pump systems to be economically competitive with other residential heating and cooling systems, ground coil over-design had to be kept at a minimum. A new ground coil model was derived, which was based on energy balance rather than the line source theory. It was aimed to accurately predict the operation of ground coils. It is, therefore, interesting to compare different ground coil models by using them to simulate the same field test data. The results indicated that the new model predicted the experimental data better than the other two models. In this paper, the above mentioned three ground coil models were selected for this study. The results indicated that the model based on energy balance predicted the test data best. 9 refs., 8 figs.

5307 (CONF-8811198–, pp. 93-108) **Examples of bioclimatic school buildings: Evaluation of demonstration building design efficacy.** Pinzuti, M. (Agip Petroli SpA, Direzione Ricerca e Sviluppo, Rome (Italy)); Pistone, G. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy consumption and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Order Number DE90724628. Available from NTIS (US Sales Only), PC A19.

After an assessment of statistical data on average energy consumption in Italian school buildings, a description is given of findings relevant to the efficacy of passive solar systems incorporated into the design of seven representative schools located in various regions of Italy. The types of systems most commonly employed were attached greenhouses and solar roof ponds. It was found that although the technologically advanced designs resulted in greater overall energy efficiency, there were notable problems, especially with regard to system maintenance requirements (seasonal adjustments relative to greenhouses), and user comfort (air circulation and day lightning requirements). More maintenance staff training was recommended, as well as greater awareness on the part of designers and school operators of the human factors implications of solar building systems.

5308 (CONF-8811198–, pp. 177-183) **Introduction to passive solar design.** Jones, R.W. (Los Alamos National Lab., NM (USA)). Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; Virgin Islands Energy Office, St. Croix (Virgin Islands). Feb 1989. From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and appliations in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in rome (Italy), 9-10 November 1988.* Order Number DE90724628. Available from NTIS (US Sales Only), PC A19.

In this examination of passive solar design philosophy, the paper defines solar design terminology and objectives in terms of economy and livability and presents brief design notes on design stages, on guidelines and evaluation methods for passive solar design and the integration of passive solar design in the design process, and on passive solar design methodology - daylighting, passive solar heating (direct and indirect gain), passive cooling and backup equipment (lighting, heating and cooling).

5309 (CONF-8811198–, pp. 209-216) **Recent advances on daylighting: European Concerted Action Programme.** Fanchiotti, A. (Rome Univ. 'La Sapienza' (Italy). Dipt. di Tecniche dell'Edilizia e del Controllo Ambientale). Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservatio and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Order Number DE90724628. Available from NTIS (US Sales Only), PC A19.

The European Concerted Action Programme on Daylighting was initiated in September 1986. It is a three-year programme, involving six main research groups from various EEC countries. Its participating researchers come from sixteen European institutions. The objective of the Programme is to provide designers with updated and reliable information and tools, to enable them to use daylighting concepts and components in the design of large, non-residential buildings, with predominantly diurnal occupation, in order to improve the visual quality of the working environment and to save energy from non-renewable sources. The paper points out the expected final results, and presents the most interesting intermediate results reached at the end of the first three semesters (March 1988) in the various research areas.

5310 (CONF-8811198–, pp. 333-343) **Thermo-hygrometrical, energetic, techno-luminous behaviour of buildings: Computerized simulation.** Calderaro, V. (Rome Univ. 'La Sapienza' (Italy). Dipt. di Disegno Industriale e Produzione Edilizia). Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Available from NTIS (US Sales Only), PC A19.

The development of this code was based on the integration of separate codes for energy optimization of greenhouses, building daylight illumination design and acoustic insulation design. The integrated program allows the evaluation, based on the finite difference method, of thermo-hygrometrical and energetic building behaviour expressed by a system of equations which represent heat flow between various points of a modular system and the heat stored in elements of accumulation. The equations of thermal balance take into account, at each node, heat flow due to radiation, conduction, convection, evaporation, condensation, natural circulation (Trombe walls, solar chimneys, etc.), as well as heat storage. Temperature behaviour at each node is simulated by the solution of these equations for a set of hourly inputs of solar radiation, temperature and relative humidity of external air, wind speed and direction. Daylighting simulation allows the calculation of the behaviour of natural lighting at various points as a function of the building's internal and external physical-geometrical characteristics, cloud cover and position of the sun. A subroutine takes into account lighting effects due to adjacent structures and surfaces. The evaluation of diffracted

sound considers the relationship between acoustic damping and the Fresnel number. It is based on the absorption characteristics of the internal environment, the acoustic insultation capacity of each external component (walls, windows, etc.), external noise level and incidence angle.

5311 (CONF-8811198–, pp. 395-401) **Thermal behaviour of buildings: Evaluation using simplified models for passive solar cooling.** Calderaro, V. (Rome Univ. 'La Sapienza' (Italy). Dipt. di Disegno Industriale e Produzione Edilizia); Ciolfi, A.; Cellie, A. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Available from NTIS (US Sales Only), PC A19.

Three models, developed for the evaluation of the total cooling requirements of residential buildings, are outlined. These are the Residential Energy Manual Method (which takes into account only seasonal and not monthly or annual variations and which is based on an assumed scale of values for local climate variability), the Super Numbers Method (developed for the calculation of heating, as well as cooling requirements), the Monthly Utilizability Method (in which an average daily solar utilizability coefficient is determined by means of thermal balance equations and in which site characteristics and type of construction are taken into account).

5312 (CONF-8811198–, pp. 301-316) **A correlation for the calculation of winter energy consumption of buildings.** Cocumo, M. (Calabria Univ., Arcavacata di Rende (Italy). Dipt. di Meccanica); Marinelli, V. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Order Number DE90724628. Available from NTIS (US Sales Only), PC A19.

A new improved correlation, based on the SIRO and EDIN codes which simulate buildings by means of three and seven walled structural models, is proposed for the estimation of the annual heating energy consumption of building. The effects of intermittent heating operation, solar heat gain and internal heat sources are considered. All the necessary information is provided to enable the application of this correlation which can be used for buildings with diverse structural typologies.

5313 (CONF-8811198–, pp. 345-373) **Energy behaviour of buildings: Analysis and comparison of principal methodologies.** Barbera, E. (Rome Univ 'La Sapienza' (Italy). Dipt. di Disegno Industriale e Produzione Edilizia); Calderaro, V. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Order Number DE90724628. Available from NTIS (US Sales Only), PC A19.

The methods compared were: Los Alamos (concentrates on the practicality of the phenomena which characterize the acquisition of energy) and Method 5000 (follows, in greater detail, such phenomena with procedures formulated by analytical calculation modules). Los Alamos allows the evaluation of solar architectural system efficiencies by the calculation of a non-dimensional parameter, 'solar energy savings fraction', in relation to the use of the systems and in consideration of primary and secondary free exchanges of energy. Performance testing by Method 5000 is accomplished through the elaboration of a volumetric coefficient of heating load in relation to system usage. Analysis of the methods reveals that the Los Alamos method is more practical and easy to use whereas Method 5000 is undoubtedly more complex but also more adaptable. Some disadvantages of each method are the following: Los Alamos - does not deal with single glazed attached greenhouses and does not allow the evaluation of the effect due to non-heated buffer zones; Method 5000 - does not provide exact correspondance between type of attached greenhouse examined and that used as reference, and presents difficulties in the evaluation of percentage coefficients of reduction for incoming solar energy and of that portion of solar energy radiated back into the environment.

5314 (CONF-8811198–, pp. 375-393) **Correlations to evaluate thermal power lost through floors resting on the soil.** Oliveti, G. (Calabria Univ., Arcavacata di Rende (Italy). Dipt. di Meccanica); Sabato, A. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1988. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the desing and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Available from NTIS (US Sales Only), PC A19.

Four correlations, obtained by numerical solution, are intended for use in the design of insulated, or not insulated, pavements resting on soil and at the same level of the surrounding land surface. The developed correlations are compared with the experimental data reported in the French normative Regles Th-K77 contained in Document Technique Unifie' (Cahiers du CSTB No. 184-1478, Paris, Nov 1987) for thermal losses calculations. This study notes that although the heat lost through pavements depends on the surface-perimeter ratio, on the temperature and the thermal conductivity of soil, these parameters were not considered in the normative.

5315 (CONF-8811198–, pp. 403-433) **Effects of energy conservation laws on the building sector (Italy).** Pela, A. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceeding of teh ISES meeting held in Rome (Italy) 9-10 November 1988.* Order Number DE90724628. Available from NTIS (US Sales Only), PC A19.

Under Italian law 308/82 several interventions were undertaken to improve the energy efficiency of buildings. These projects for which relevant statistical data are reported in this paper, involved the optimization of energy management, retrofitting to improve equipment efficiency, heat recovery schemes, fuel substitution with renewable energy sources (i.e. solar) and complete modification of energy systems. With the use of the collected regional data, an assessment is made of the effectiveness, especially with regard to economic aspects, of the interventions which have taken place and suggestions are made for improvements to be incorporated into future energy conservation legislation. Attention is brought to the role that administrative offices must play in the greater diffusion of public information regarding technological innovations in building heating systems and in the creation of greater incentives to encourage the implementation of energy saving measures in the building sector.

5316 (CONF-8811198–, pp. 435-438) **Incentives for bioclimatization of buildings (Lombardia, Italy).** Burzilleri, L. (Assessorato ai problemi dell'energia della Regione Lombardia, Milan (Italy)); Zabot, S. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian).

From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Available from NTIS (US Sales Only), PC A19.

The measures being adopted by the regional administrative offices of Lombardia in Italy to support local building bio-climatization schemes are directed mainly towards: the training and updating of designers; legal and financial incentives to builders; research studies; and technical assistance to designers. This paper amplifies the description of these measures, reports on the present situation and future plans.

5317 (CONF-8811198–, pp. 439-454) **Comparison and assessment of principal international normatives on energy conservation in buildings.** Calderaro, V. (Rome Univ. 'La Sapienza' (Italy). Dipt. di Disegno Industriale e Produzione Edilizia); Tiribelli, S. Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Available from NTIS (US Sales Only), PC A19.

With regard to different national (E.E.C., Canada, Australia and USA) building energy conservation normatives, the elements in common that were reviewed were the following: thermal conductivity of building insulation (good agreement); glazing coefficient of heat transfer (Belgian formulation most complete); building heat dispersion elements (general disagreement on the interpretation of total window area in heat dispersion calculations); calculation of thermal bridges (Frech method appears to be the most accurate); building elements in contact with ground surfaces (can only be accomplished by computerized calculations - French method most complete); average internal temperatures for heating and cooling load calculations (vary between 18 and 22 degrees C heating); external temperatures and degree days (methods vary); heat transfer coefficient corrections (not taken into account in some countries); degree of ventilation (variable); insolation; heat contributions from internal sources (Belgian, Danish and French methods appear to be most accurate); solar and internal heat utilization factors (methods vary).

5318 (DOE/CE–0277) **Technical support document: Energy conservation standards for consumer products: Refrigerators and furnaces including: environmental impacts regulatory impact analysis.** USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC (USA). Building Equipment Div. Nov 1989. 396p. Sponsored by U.S. DOE Conservation & Renewable Energy. Order Number DE90003491. Available from NTIS, PC A17/MF A01 - OSTI; GPO Dep.

The National Appliance Energy Conversation Act (NAECA) of 1987 (P.L. 100-12) establishes energy efficiency standards for 13 types of consumer products. The legislation requires the Department of Energy (DOE) to consider new or amended standards on these and other types of products at specified times. DOE is currently selecting standards for two types of products: refrigerators, refrigerator-freezers, and freezers; and small gas furnaces. This Technical Support Document presents the methodology, data and results from the analysis of the energy and economic impacts of the proposed standards. 8 refs., 39 figs., 135 tabs.

5319 (DOE/CE/15256–T2) **Rotary absorption heat pump sensitivity analysis final report.** Bamberger, J.A. (Pacific Northwest Lab., Richland, WA (USA)); Zaloudek, F.R. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 75p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG01-86CE15256. Order Number DE90002877. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Conserve Resources, Incorporated is currently developing an innovative, patented absorption heat pump. The heat pump uses rotation and thin film technology to enhance the absorption process and to provide a more efficient, compact system. The purpose of this report is to present the results of a sensitivity analysis of the rotary absorption heat pump (RAHP) performance conducted to further the development of a 1-ton RAHP. 5 refs.

5320 (DOE-tr–89-13) **New heating and cooling technology: Regenerative heat pump according to the Vuilleumier principle.** (Neuartigen heiz- und kuhltechnik: Regenerative waermepumpe nach dem Vuilleumier-prinzip). Eder, F.X. USDOE, Washington, DC (USA). 1989. 19p. Translation source information not available. Order Number DE90002701. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The regenerative heat pump which can be heated from outside which has been developed by the firm PETRY, Neumarkt/Opf. West Germany and was supported by the Bavarian Economic Ministry, is based on a circular process invented by VUILLEUMIER and patented in 1918. During the 60's this principle was used in the construction of thermally propelled cold machines of low power. It was used for temperatures down to −50°C (illegible) for cooling, for example, infrared detectors and similar devices. Its practical use as a heat pump or cold aggregate for higher heat performances was analyzed for the first time in 1981 by the author at the firm ASK-Bayreuth. But it was only in 1984, during collaboration with the firm PETRY, that an operational and high performance design was established. 14 figs.

5321 (EPRI-CU–6556) **Office productivity and workstation environment control workshop: Research planning: Proceedings.** Electric Power Research Inst., Palo Alto, CA (USA); Whiddon (W.I.) and Associates, Inc., Winchester, VA (USA); Ostgren Associates, Inc., San Francisco, CA (USA). c Nov 1989. 56p. Sponsored by Electric Power Research Institute. (CONF-8810445–Summ.: Office productivity and workstation environment control workshop, Palo Alto, CA (USA), 11-12 Oct 1988). Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The purpose of this R & D planning workshop was to identify and define specific office building industry research that will lead to new and/or improved uses of electricity to provide individual (local) office environment control and increase office worker productivity. The workshop conducted October 11–12, 1988 was the third in a series of meetings held to identify research needs related to office productivity. Participants included experts in the fields of office acoustics, lighting, thermal comfort, air quality, environmental system controls, space planning, automation, and productivity. The first meeting was held May 31–June 1 to broadly define issues related to office productivity research and limitations in existing office environmental systems. A second meeting was held August 22–23 with another group of experts to define the state of the art in office environmental systems and productivity measurement and to begin to identify specific research that could lead to improved systems (and increased productivity). Recommendations from this group became the basis for workshop discussions. The October workshop combined the participants from the first two meetings and added a new group of experts to respond to the conclusions being developed from the earlier work. 3 figs., 2 tabs.

5322 (ETDE/CA-MS–M91-7/44-1989E) **Residential training and retrofit project: Final report.** Department of Energy, Mines and Resources, Ottawa, ON (Canada). Remote Community Demonstration Program. [1989]. 69p. (MICROLOG–89-03922). Available from PC Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This report presents the results of a project to facilitate the learning and application of energy efficient retrofit measures and safe, efficient wood burning practices in 5 remote northern Saskatchewan communities. As well, the project demonstrated the benefits of employing these measures by producing a more comfortable and healthier living environment. The project was divided into training, retrofit, and monitoring phases. A resident of each community first

attended a 2-week training course on retrofitting for energy conservation and wood heat safety. One demonstration home in each participating community was retrofited by the local trainee, the project manager, and technical officer from Energy, Mines and Resources Canada. Monitoring was done for 1 year following the completion of the work. Results were very positive and recommendations are included. Also included in the report are the text of the Contribution Agreement, final report for Phases 1 and 2, radon and formaldehide results, and the final report on the Nova Scotia Municipal Air Seal project.

5323 (ETDE/GA-MS–M91-7/45-1989E) **R-2000 Band office of the Hatchet Lake Band, Wollaston Lake, Saskatchewan: Final report.** Department of Energy, Mines and Resources, Ottawa, ON (Canada). Remote Community Demonstration Program. Mar 1989. 93p. (MICROLOG–89-03920). Available from PC Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This report describes the construction, monitoring, and information transfer of the building of a new Band office at R-2000 levels for the Lac La Hache Indian Band in northern Saskatchewan. The Band coordinated the planning, design, and construction of the project and 6 Band members were employed on the project as part of a separately-funded training program. The report describes the building construction, the various monitoring tests performed over one year, and the information program consisting of project summaries, news coverage, a workshop, slides and a slide presentation. Appendices contain monthly monitoring reports, formaldehyde and radon results, an air quality report, and the project summary.

5324 (LBL–26069) **A superwindow field demonstration program in northwest Montana.** Arasteh, D.; Selkowitz, S. Lawrence Berkeley Lab., CA (USA). Sep 1989. 9p. Sponsored by U.S. DOE Conservation & Renewable Energy; U.S. DOE Management & Administration. DOE Contract AC03-76SF00098;AI79-86BP63401. (CONF-891202–6: 4. thermal performance of the exterior envelopes of buildings, Orlando, FL (USA), 4-7 Dec 1989). Order Number DE90003268. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Of all building envelope elements, windows always have had the highest heat loss rates. However, recent advances in window technologies such as low-emissivity (low-E) coatings and low-conductivity gas fillings have begun to change the status of windows in the building energy equation, raising the average R-value (resistance to heat flow) from 2 to 4 h-ft^2-°F/Btu. Building on this trend and using a novel combination of low-E coatings, gas-fills, and three glazing layers, the authors developed a design concept for R-6 to R-10 "super" windows. Three major window manufacturers produced prototype superwindows based on this design for testing and demonstration in three utility-sponsored and -monitored energy-conserving homes in northwestern Montana. This paper discusses the design and tested performance of these three windows and identifies areas requiring further research if these window concepts are to be successfully developed for mass markets. 11 refs., 3 figs., 3 tabs.

5325 (LBL–26070) **Fenestration performance analysis using an interactive graphics-based methodology on a microcomputer.** Sullivan, R.; Selkowitz, S. Lawrence Berkeley Lab., CA (USA). Sep 1989. 13p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. (CONF-891202–5: 4. thermal performance of the exterior envelopes of buildings, Orlando, FL (USA), 4-7 Dec 1989). Order Number DE90003276. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We show the development and implementation of a new methodology that can be used to evaluate the energy and comfort performance of fenestration in non-residential buildings. The methodology is based on the definition of a fenestration system "figure of merit." The "figure of merit" is determined by considering five non-dimensional performance indices representing heating energy, cooling energy, cooling energy peak, thermal comfort, and visual comfort. These indices were derived by performing a regression analysis of several thousand hour-by-hour building heat transfer simulations of a prototypical office building module using the DOE-2 simulation program. The regression analysis resulted in a series of simplified algebraic expressions that related fenestration configuration variables to performance parameters. We implemented these equations in a "hypermedia" environment – one that integrates graphics, sound, animation, and calculation sequences –and created a prototype fenestration performance design tool. Inputs required by the program consist of geographic location, building type, perimeter space, and envelope definition. Outputs are the calculated performance indices for electricity and fuel use, peak electric load, and thermal and visual comfort. 6 refs., 7 figs.

5326 (LBL–27210) **Conservation potential of compact fluorescent lamps in India and Brazil.** Gadgil, A. (Lawrence Berkeley Lab., CA (USA)); Martino Jannuzzi, G. de. Lawrence Berkeley Lab., CA (USA). Jul 1989. 46p. Sponsored by U.S. DOE Conservation & Renewable Energy; U.S. DOE Environment Health & Safety. DOE Contract AC03-76SF00098. Order Number DE90002611. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We evaluate the conservation potential of compact fluorescent lamps (CFLs) for managing the rapidly increasing electrical energy and peak demand in India and Brazil. Using very conservative assumptions, we find that the cost of conserved energy using 16 W CFLs is 4 and 6 times less than the long range marginal cost of electricity for the two countries. The cost of avoided peak installed capacity is 6 and 9.5 times less than the cost of new installed capacity for India and Brazil. The analysis is undertaken from the three separate perspectives of the national economies, the consumers, and the utilities. We find that because residential electricity is subsidized, the consumers have little or no incentive to purchase and install the CFLs, unless they too are subsidized. However, the benefits of CFL installation to the utility are so large that subsidizing them is a paying proposition for the utility are so large that subsidizing them is a paying proposition for the utility in almost all cases. As an illustration of a gradual introduction strategy for CFLs, we calculate a scenario where national savings of the order of US $1.2 million per day for India and US $2.5 million per day for Brazil are reached in 10 years by a small and gradual transfer of subsidy from residential electricity to CFLs. We then explore the barriers to immediate large scale introduction of these lamps in the two countries. Specific technical and marketing problems are identified and discussed, which would require solution before such an introduction can be attempted. Lastly, we discuss the range of policy instruments, in addition to a subsidy scheme, that can be used for promoting the diffusion of these lamps in the domestic and commercial sector. 47 refs., 15 figs., 2 tabs.

5327 (LBL–27658) **Workshop proceeding of the industrial building energy use.** Akbari, H.; Gadgil, A. (eds.). Lawrence Berkeley Lab., CA (USA). [1988]. 94p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC03-76SF00098. (CONF-8811248–: Workshop on industrial building energy use, Berkeley, CA (USA), 7 Nov 1988). Order Number DE90002599. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

California has a large number of small and medium sized industries which have a major impact on the demand growth of California utilities. Energy use in building services (lighting, HVAC, office equipment, computers, etc.). These industries constitute an important but largely neglected fraction of the total site energy use. The ratio of energy use in building service to the total site energy use is a function of the industrial activity, its size, and the climate at the site of the facility. Also, energy use in building services is more responsive to weather and occupant schedules than the traditional "base-load" industrial process energy. Industrial energy use is considered as a "base-load" by utility companies because it helps to increase the utilities' load factor. To increase this further, utilities often market energy at lower rates to industrial facilities. Presently, the energy use in the building services of the industrial sector is often clubbed together with industrial process load. Data on non-process industrial energy use are not readily available in the literature. In cases where the major portion of the energy is used in the building services (with daily and seasonal load profiles that in fact peak at the same time as systemwide load peaks), the utility

may be selling below cost at peak power times. These cases frequently happen with electric utilities. 30 figs., 6 tabs.

5328 (LPC–61-1424-9-88) **Glossary of heating techniques.** Lexicon Project Committee, Fredericton, NB (Canada). Jun 1988. 134p. (MICROLOG–89-02096). Available from PC New Brunswick Legislative Library, Government Documents Section, 766 King Street, Fredericton, NB, CAN E3B 5H1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This glossary standardizes the terminology used in provincial and interprovincial examinations, course outlines, occupational analysis, and instructional material for more than 30 trades concerned with heating techniques. The glossary is divided into English-French and French-English. An extensive source list is included.

5329 (NRC–29348E) **Window performance and new technology. Proceedings of Building science insight '88.** National Research Council of Canada, Ottawa, ON (Canada). Aug 1988. 75p. (MICROLOG–89-03241). Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A series of seminars was held in Canada on windows, and papers were presented on general aspects of window performance, factors that affect window performance, testing of windows, the relation of windows to the building envelope, and new technologies related to windows. Separate abstracts have been prepared for five papers from this seminar.

5330 (NRC–29348E, pp. 59-69) **New technology in the window industry.** Elmahdy, A.H.; Cornick, S.M. National Research Council of Canada, Ottawa, ON (Canada). Aug 1988. (MICROLOG–89-03241). In *Window performance and new technology. Proceedings of Building science insight '88.* Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

New developments in the window industry, resulting from advances in physics and engineering, are reviewed. Several advances have occurred that have an impact on thermal resistance, surface temperature, solar characteristics, and structural performance of windows. In addition, the drive for energy conservation and comfort, and the high cost of retrofitting, has led to many developments in window design and materials that relate to improved thermal performance, installation, operation, fire resistance, and maintenance. In the area of glazings, these developments include low emissivity glazings, low emissivity coatings, gas-filled seal insulated glazing, switchable (chromogenic) glazing, and structural glazing systems. In the area of materials, recent developments include the use of fiberglass and polyurethane frames and silicone spacers in multiple glazing units. Innovative window designs include air-flow (or ventilated) windows, sealed glazing units with capillary tubes for accommodating pressure changes, and sprinklered windows for increased fire resistance. Some new computer models used in modelling window performance are briefly mentioned. 39 refs., 12 figs.

5331 (NRC–29348E, pp. 47-58) **Integrating the window with the building envelope.** Patenaude, A.; Scott, d.; Lux, M. National Research Council of Canada, Ottawa, ON (Canada). Aug 1988. (MICROLOG–89-03241). In *Window performance and new technology. Proceedings of Building science insight '88.* Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Details are provided on the installation of windows in the building envelope, showing how the window and wall elements are joined and operate as a system. Discussion presented in this paper includes the continuity of window-wall elements or providing air barriers, weather protection, and thermal insulation; reducing condensation potential, with the location of the thermal break being the critical factor; tolerance considerations for window-wall junctions, taking into account load transfer, structural support, anchorage systems, and thermal expansion; joint design and sealant selection; and whether or not to test the window system using a mockup. 5 refs., 15 figs., 3 tabs.

5332 (NRC–29348E, pp. 31-48) **The system approach to window performance standards.** Ellmahdy, A.H.; Patenaude, A. National Research Council of Canada, Ottawa, ON (Canada). Aug 1988. (MICROLOG–89-03242). In *Window performance and new technology. Proceedings of Building science insight '88.* Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The standards and specifications that relate to windows as an independent system are reviewed. Significant advances in meeting the needs of establishing a common set of criteria and methods for assessing windows in Canada have resulted in the development of a new performance standard, which is the focus of this paper. In this standard, a single test specimen, consisting of a new factory-assembled window of specific model, complete with hardware and screens if applicable, is used for the entire series of performance tests. Tests for air leakage, water resistance, and wind load resistance are performed in this sequence. Other tests, including ease of operation, condensation resistance, resistance to forced entry, blocked operation, safety drop, sash strength and stiffness, screen strength, and sash pulloff, are performed, at the discretion of the testing agency. The intent of each test, the apparatus and procedures used, and the performance required are described for each test. In some cases, comparisons with foreign standards are provided. 20 refs., 15 figs., 12 tabs.

5333 (NRC–29348E, pp. 29-46) **The system approach to window performance standards.** Elmahdy, A.H.; Patenaude, A. National Research Council of Canada, Ottawa, ON (Canada). Aug 1988. (MICROLOG–89-03241). In *Window performance and new technology. Proceedings of Building science insight '88.* Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

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5334 (NRC–29348F) **Window performance and new technology. Proceedings of Building science insight '88.** National Research Council of Canada, Ottawa, ON (Canada). Aug 1988. 80p. (In French). (CONF-8906253–: 15. annual conference of the Solar Energy Society of Canada, Penticton (Canada), 19 Jun 1989; MICROLOG–89-03242). Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A series of seminars was held in Canada on windows, and papers were presented on general aspects of window performance, factors that affect window performance, testing of windows, the relation of windows to the building envelope, and new technologies

related to windows. Separate abstracts have been prepared for five papers from this seminar.

5335 (NRC–29348F, pp. 49-62) **Integrating the window with the building envelope.** Patenaude, A.; Scott, d.; Lux, M. National Research Council of Canada, Ottawa, ON (Canada). Aug 1988. (CONF-8906253–: 15. annual conference of the Solar Energy Society of Canada, Penticton (Canada), 19 Jun 1989; MICROLOG–89-03242). In *Window performance and new technology. Proceedings of Building science insight '88.* Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

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5336 (NRC–29348F, pp. 63-74) **New technology in the window industry.** Elmahdy, A.H.; Cornick, S.M. National Research Council of Canada, Ottawa, ON (Canada). Aug 1988. (CONF-8906253–: 15. annual conference of the Solar Energy Society of Canada, Penticton (Canada), 19 Jun 1989; MICROLOG–89-03242). In *Window performance and new technology. Proceedings of Building science insight '88.* Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

New developments in the window industry, resulting from advances in physics and engineering, are reviewed. Several advances have occurred that have an impact on thermal resistance, surface temperature, solar characteristics, and structural performance of windows. In addition, the drive for energy conservation and comfort, and the high cost of retrofitting, has led to many developments in window design and materials that relate to improved thermal performance, installation, operation, fire resistance, and maintenance. In the area of glazings, these developments include low emissivity glazings, low emissivity coatings, gas-filled sealed insulated glazing, switchable (chromogenic) glazing, and structural glazing systems. In the area of materials, recent development include the use of fiberglass and polyurethane frames and silicone spacers in multiple glazing units. Innovative window designs include air-flow (or ventilated) windows, sealed glazing units with capillary tubes for accommodating pressure changes, and sprinklered windows for increased fire resistance. Some new computer models used in modelling window performance are briefly mentioned. 39 refs., 12 figs.

5337 (NRC–29348F, pp. 17-28) **Window performance factors.** Brown, W.C.; Ruberg, K. National Research Council of Canada, Ottawa, ON (Canada). Aug 1988. (In French). (CONF-8906253–: 15. annual conference of the Solar Energy Society of Canada, Penticton (Canada), 19 Jun 1989; MICROLOG–89-03242). In *Window performance and new technology. Proceedings of Building science insight '88.* Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Window performance factors discussed in this paper include those that arise because of the light transmission properties of windows as well as those that are applicable to opaque walls. Discussion is presented in three major areas: windows as energy filters, as part of the building envelope, and as a building component. Historically, windows have been installed primarily to provide light and a view, and other performance factors were balanced against this. After light and view, the most commonly used performance criterion is thermal performance, involving heat transmission (heat loss from a heated interior to a colder exterior, and solar gain) and surface temperature factors (moisture condensation and its effects on the durability of the window system). As part of the building envelope, windows must be able to withstand structural stresses and must function as air, vapor, and water barriers. Once installed, they must conform to expected modes of operation as modes of egress and as means for ventilation. 31, refs., 7 figs., 2 tabs.

5338 (NRC–29348F, pp. 1-16) **Windows: Overview of issues.** Rousseau, M.Z. National Research Council of Canada, Ottawa, ON (Canada). Aug 1988. (In French). (CONF-8906253–: 15. annual conference of the Solar Energy Society of Canada, Penticton (Canada), 19 Jun 1989; MICROLOG–89-03242). In *Window performance and new technology. Proceedings of Building science insight '88.* Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This paper examines the nature of the requirements for windows from three points of view: a window as a system of elements, as part of the building envelope, and as part of the indoor environment. It also describes briefly the current array of windows and window components on the market in Canada. Requirements discussed include those relating to heat flow, air leakage, water vapor flow, condensation, rain penetration, operation, strength, and durability. The nature of the connection between the building envelope and the window, and of materials typically used in window glazings, are also reviewed. 6 refs., 15 figs., 1 tab.

5339 (ORNL/FTR–3493) **[Airflow patterns within buildings]: Foreign trip report, November 11, 1989–November 17, 1989.** Harrje, D.T. Oak Ridge National Lab., TN (USA). 20 Nov 1989. 12p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC05-84OR21400. Order Number DE90003521. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The fourth experts meeting of Annex 20, Airflow Patterns Within Buildings took place on November 13–16, 1989 in Delft, Netherlands and CenterParc DeVossemeren, Lommel, Belgium. The operating agent, A. Moser (SW) updated the status of France, which is awaiting official approval as the 13th country. The attendance at the meeting was 38 experts. Subtask I, Single-Room Air and Contaminant Flow, is being led by T. Lemaire (NL), and emphasizes test room flow modeling and multicountry intercomparisons for a number of specified test situations. Improved airflow models is a prime goal and excellent progress has been made on all topics. Subtask II, Multizone Air and Contaminant Flow and Required Measurement Techniques, is being led by C-A. Roulet (SW). The emphasis in that task, where the US is directly involved, includes flow through large openings, simulated use of doors and windows, contaminant movement, multiroom ventilation efficiency, multizone airflow measurement methods and enhanced leakage distribution measurement methods, and data bases and data sets. Some of the topic areas have already reached the draft stage with two detailed reports possibly ready by the next meeting. Progress has been excellent to date. Laboratory visits emphasized test room facilities, wind tunnel testing of model buildings, specialized instrumentation, computer modeling of numerous test cases and a design program for HVAC systems in new buildings. The research is being done in two laboratories of TNO, Delft. 4 refs.

5340 (PB–89-218762/XAB) **Influences of HVAC (heating, ventilating, and air conditioning) design and operation on radon mitigation of existing school buildings. Report for December 1987-March 1989.** Leovic, K.W.; Craig, A.B.; Saum, D. Infiltec, Falls Church, VA (USA). Mar 1989. 21p. Available from NTIS, PC A03/MF A01.

This paper discusses various school building characteristics identified as influencing radon entry, the design and operation of installed mitigation systems in four Maryland schools, and the success of these systems in reducing school radon levels. Results indicate that one of the most significant factors contributing to elevated radon levels in schools is room depressurization caused by the HVAC system exhausting more air from a room than the supply

fan is furnishing to the room. Conversely, if the HVAC system pressurizes the room, radon entry can often be prevented as long as the fan is operating. Four Maryland schools with varying types of HVAC systems have had mitigation systems installed to reduce elevated levels of indoor radon. Mitigation techniques include depressurization of the area under the slab, sometimes accompanied by the sealing of cracks and holes, and the temporary reduction of radon levels by pressure control through the HVAC system. These systems were effectively reducing radon levels following their installation during the summer of 1988.

5341 (PNL–6986) **Whole-building systems integration laboratory survey: Survey of engineering school faculty.** Crawley, D.B. (American Consulting Engineers Council, Washington, DC (USA). Research and Management Foundation). Pacific Northwest Lab., Richland, WA (USA); American Consulting Engineers Council, Washington, DC (USA). Research and Management Foundation. Sep 1989. 21p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. Order Number DE90003428. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report was prepared for the Pacific Northwest Laboratory as a subcontracted activity by the Research & Management Foundation of the American Consulting Engineers Council. The objective of the survey reported herein was to independently assess the need for a Building System Integration Laboratory from the viewpoint of academicians in the field of building science. The subcontractor-developed questionnaire was sent to 200 professors of architecture and engineering at US universities. In view of this diverse population, the 10% rate of return on the questionnaire was considered acceptable. Although the responses probably do not reflect an unbiased summary of the collective perceptions of the original population surveyed, they do provide a valid insight into the interests and concerns of the academic community with respect to building sciences issues.

5342 (PNL–6991) **First workshop on the Building System Integration Laboratory.** Drost, M.K.; Johnson, B.M.; Crawley, D.B. Pacific Northwest Lab., Richland, WA (USA). Sep 1989. 33p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. (CONF-8804308–Summ.: 1. workshop on the Building System Integration Laboratory, Washington, DC (USA), 5-6 Apr 1988). Order Number DE90003016. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The Whole Building Systems Integration Laboratory (WBSIL) feasibility study was initiated by the US Department of Energy (DOE) to determine the feasibility of constructing a laboratory dedicated to the investigation of whole-building system-integration issues. The Pacific Northwest Laboratory (PNL) is conducting this study. To ensure the feasibility study receives a wide range of input, an advisory committee has been formed to assist in establishing the functional criteria for the WBSIL. The advisory committee consists of nationally recognized experts in a variety of disciplines related to building research, design and operation. The original plan was for the advisory committee to provide guidance for the study in three forms. First, the advisory committee was to complete a questionnaire on whole building research issues and products. This was to be followed by the first workshop where the advisory committee would provide information on the need for the WBSIL and on its required design features. Finally, the advisory committee was to meet a second time to provide a review of the conceptual design of the facility and the functional criteria.

5343 **The impact of summer heat island on residential cooling energy consumption.** Akbari, H. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (US)). vp of The 8th Miami international conference on alternative energy sources. Volume 1-2 (Condensed Papers). Vezioglu, T.N. Clean Energy Research Inst. University of Miami, Coral Gables, FL (1988). (CONF-871204–: 8. Miami international conference on alternative energy sources, Miami Beach, FL (USA), 14-16 Dec 1987).

Man has created summer heat islands of daily average intensity of 3-5 C, adding to discomfort and resulting in 10-15% increases in air conditioning loads. (The LA basin uses 5 GW of air conditioning, thus tying up 10 billion of power plants and another 5-10 billion in HVAC equipment). The authors have been studying how to mitigate this heat, for example by replanting vegetation, paving streets with white concrete instead of asphalt, and moving to white buildings with reflective roofs. In this study, they correlate the urban heat island to residential cooling energy and power consumptions, with specific case studies for selected U.S. cities. The effect of selected strategies (evapotranspiration and shading) and their potential in reducing the heat island induced cooling load is simulated.

5344 **Random vibration analysis of rattling structures.** Paez, T.L. (Experimental Mechanics Dept., Sandia National Labs., Albuquerque, NM (US)); Ernest, T.L. vp of The 1988 proceedings of the Institute of Environmental Sciences: The visions of yesterday are the realities of today. Institute of Environmental Sciences, Mt. Prospect, IL (1988). (CONF-8805167–: 34. Institute of Environmental Sciences annual technical meeting: the visions of yesterday are the realities of today, King of Prussia, PA (USA), 3-5 May 1988).

An excitation-response model is developed for structural systems that have the potential for rattling response. The mathematical model is used to establish spectral relations for stationary random excitation and response, and the model is applied to a laboratory experiment. The spectral density and ordinary coherence characteristics of a system with rattling are developed. It is shown that the mathematical model can accurately reflect the features of randomly excited structural motion in a rattling structure.

3202 Transportation

Refer also to citation(s) 4957, 5389, 5392, 5396

5345 (CONF-8902150–1) **Object-oriented programming in traffic simulation.** Rodriguez, J.J. (Vanderbilt Univ., Nashville, TN (USA). Dept. of Electrical Engineering); Chin, Shih-Miao; Santiago, A.; Roland, R. Oak Ridge National Lab., TN (USA). 9 Oct 1989. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 1989 Engineering Foundation conference on traffic control methods; Santa Barbara, CA (USA); 26 Feb - 3 mar 1989. Order Number DE90002933. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Object-oriented programming has been referred to as a new style of computer programming that differs from conventional structured programming in that solutions to problems are obtained as more "natural" activity. Current implementations of traffic simulation models lack explicit representations of the assumptions made about the real world. Thus, they have become increasingly more difficult to understand as new changes are added or new modifications are made. An object-oriented approach to traffic simulation modeling will overcome some of these problems and promises to offer a new alternative solution. This paper introduces, by means of examples, the concepts of object-oriented programming and provides some starting considerations necessary to develop a general framework for building a traffic simulation tool based on the object-oriented paradigm of computer problem solving. 11 refs., 6 figs.

5346 (NRC–29197, pp. 343-347) **Microcomputer planning model improves efficiency in aerial spray project.** Rumpf, D.L. (Northeastern Univ., Boston, MA (USA)); Melachrinoudis, E. National Research Council of Canada, Ottawa, ON (Canada). Oct 1987. (CONF-8710504–: Symposium on the aerial application of pesticides in forestry, Ottawa (Canada), 20-22 Oct 1987; MICROLOG–89-03259). In *Proceedings [of the] symposium on the aerial application of pesticides in forestry*. Available from PC Canadian Forestry Service, Government of Canada, 351 St. Joseph Boulevard, Hull, PQ, CAN K1A 1G5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

In Maine, insect control in forests requires yearly spraying of almost a million acres within a 2-4 week insect vulnerability window. The spraying is accomplished by using up to 30 aircraft flying from 8 airfields to spray 300-400 treatment areas (spray blocks). In an attempt to reduce operating costs for the spray project, a linear programming model was developed and tested. The model minimizes total aircraft operating cost (fuel, depreciation, maintenance, and pilot salaries). It explicitly considers distance limitations, flying cost for each aircraft type, time available for effective spraying, and insecticide requirements. The output of the model is the least-cost set of

flight plans. This paper describes the planning problem, the linear programming model and the resulting microcomputer-based model, and the use of the model for the 1983-85 spraying programs. During that period, the amount of endangered forest declined dramatically along with the total acreage sprayed. However, contrary to an expected increase in cost of spraying per acre, the net result of using the model actually lowered the cost per acre. 4 refs., 3 tabs.

5347 (PB–89-231427/XAB) **Dallas area rapid-transit-service privatization: A summary of benefits/risks for transit providers.** Webster, B.A. North Central Texas Council of Governments, Arlington, TX (USA). Aug 1988. 57p. Available from NTIS, PC A04/MF A01.

Dallas Area Rapid Transit (DART) is a national leader in the field of transit privatization. This study documents the privatization efforts of DART for the Urban Mass Transportation Administration (UMTA). The results will allow other transit providers the opportunity to understand the benefits and potential risks of contracting for services from the private sector. Considered are the socio-economic, political, financial, technical, and user-demand characteristics from the 1970s through 1988 at the local, state, and national levels that influenced privatization. Accompanying data provide information to transit operators concerning the potential viability of contracting transit services.

5348 (PB–89-231856/XAB) **Assessment of travel-demand approaches at suburban activity centers. Final report, October 1988-April 1989.** Bhatt, K.; Higgins, T. K.T. Analytics, Inc., Frederick, MD (USA). Jul 1989. 45p. Available from NTIS, PC A03/MF A01.

Local governments are turning to demand management or trip-reduction strategies, policies, and programs to combat traffic congestion. Localities are encouraging employers and developers to implement transportation-systems management (TSM) and parking management strategies (PM). The study describes experiences with TSM and PM through employer case studies and literature reviews. It provides recommendations to local government decision makers and planners on strategy effectiveness and reduction policy instruments. Recommendations are offered about: when TSM and PM strategies and policies are appropriate; consideration in selecting policy instruments; suggestions on policy design; and guidance on program monitoring, enforcement, management, costs and timeliness. Recommendations for the Federal Government include development of model ordinances, developer agreements, parking codes, and guidelines supportive of local policies; changes in tax law on parking subsidies and parking policies for federal employees; support of Transportation Management Association roles in parking management; coordination with air-quality regulations; and future research on suburban successes and failures.

5349 (PB–89-873046/XAB) **Pipeline-system insulation: Thermal insulation and corrosion prevention. December 1985-September 1989 (Citations from the Rubber and Plastics Research Association data base). Report for December 1985-September 1989.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 231p. Available from NTISPC N01/MF N01.

Supersedes PB–88-858329.

This bibliography contains citations concerning thermal and corrosion insulating of pipeline systems utilized to transfer liquids and gases. Thermal aging of polyurethane foam for insulating heating pipes, extrusion-film pipeline insulation materials and processes, flexible expanded nitrile-rubber pipeline insulation with class 1 fire rating, and underground fiberglass-reinforced polyester-insulated pipeline systems are among the topics discussed. Applications in solar heating systems, underground water, oil, and gas, interior hot water and cold water lines under seawater, and chemical plant pipeline system insulation are included. (This updated bibliography contains 231 citations, 92 of which are new entries to the previous edition.)

5350 (QU/CIGGT–88-6) **Low-friction snow plow evaluation.** Clouston, G.J. (Queen's Univ., Kingston, ON (Canada)); English, G.W.; Young, J.D. Queen's Univ., Kingston, ON (Canada). Canadian Inst. of Guided Ground Transport. Sep 1988. 41p. (MICROLOG–89-04065). Available from PC Transport Canada, Library and Information Centre, Place de Ville, Tower C, Ottawa, ON, CAN K1A 0N5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Canadian railway traffic is delayed until lines are plowed of snow following heavy snowfalls. A modification that would permit higher plowing speeds and fewer delays could realize significant benefits in addition to direct fuel and labor savings. The objective of this project was to carry out a cost benefit analysis on a low-friction coating applied to a mainline railway snow plow. The assessment was carried out using old Canadian National Railway snow plows for test purposes. An analytical model was developed to estimate the importance of friction reduction to fuel consumption and power requirements. The sensitivity analysis revealed a bump or discontinuity in the power vs speed profile, corresponding to the minimum plow speed at which the snow will cease to flow over the plow. Reducing the coefficient of friction reduces this minimum plowing speed. This could mean the difference between success and failure in plowing some tight, heavily laden snow drifts. The analysis also revealed that this coefficient does not seem to drastically alter the power required to plow snow above the minimum speed. A qualitative assessment of the benefits of the coating was made by the plow crews. After two winters of service, the coating had not visibly deteriorated, although there were some spots where it was abraded away. On the basis of theoretical analysis alone, it appears that low-friction coatings of railway snow plows do not meet the goal of a return on investment of 15%. Fuel savings are estimated to be minimal and the labor savings offer about an 11% return at the better of 2 scenarios. However, the indirect benefits of reduced train delays would only have to be in the range of $250-$300 annually to provide a 15% real return for this scenario. 26 figs.

5351 (SAND–89-0623) **Geometric considerations for a waypoint guidance method.** Perdreauville, F.J. Sandia National Labs., Albuquerque, NM (USA). Sep 1989. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE90001803. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Waypoint guidance is a technique used to steer an autonomous vehicle along a desired course. Waypoints are designated at intervals along that course. The guidance algorithms issue steering commands that, if followed, result in the vehicle's traveling from waypoint to waypoint. Thus, the vehicle remains on or very close to the desired trajectory. Waypoints can be specified by latitude, longitude, and altitude in geographic coordinates. The vehicle's current location can be described similarly. This is enough information to determine the direction of travel that would take the vehicle to the waypoint. The shortest route from one point on a spherical surface to another on the same surface is a great circle. A great circle lies in a plane that contains the center of the sphere. The plane also is normal to the surface of the sphere along the great circle. The earth actually is distorted slightly from spherical; it is ellipsoidal. An ellipsoidal earth model will be used in this report. Features of the great circle will be applied to effect good approximations of shortest routes to waypoints. Therefore, only the endpoints of long, straight course segments need be specified. 5 figs.

5352 (UCRL–101677) **Laser-supported detonation waves and pulsed laser propulsion.** Kare, J.T. Lawrence Livermore National Lab., CA (USA). [1989]. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890756–4: 17. international symposium on shock waves and shock tubes (STS-17), Bethlehem, PA (USA), 17-21 Jul 1989). Order Number DE90002753. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A laser thermal rocket uses the energy of a large remote laser, possibly ground-based, to heat an inert propellant and generate thrust. Use of a pulsed laser allows the design of extremely simple thrusters with very high performance compared to chemical rockets. The temperatures, pressures, and fluxes involved in such thrusters (10^4 K, 10^2 atmospheres, 10^7 w/cm^2) typically result in the creation of laser-supported detonation (LSD) waves. The thrust cycle thus involves a complex set of transient shock phenomena, including laser-surface interactions in the ignition if the LSD wave, laser-plasma interactions in the LSD wave itself, and high-temperature nonequilibrium chemistry behind the LSD wave. The SDIO Laser Propulsion Program is investigating these phenomena as part of an

overall effort to develop the technology for a low-cost Earth-to-orbit laser launch system. We will summarize the program's approach to developing a high performance thruster, the double-pulse planar thruster, and present an overview of some results obtained to date, along with a discussion of the many research questions still outstanding in this area. 16 refs., 7 figs.

3203 Industrial and Agricultural Processes

Refer also to citation(s) 4735, 4917, 4954, 4981, 5222, 5223, 5282, 5320, 5373, 5618

5353 (AC/CB–1775/E) **Saving energy and dollars on the farm.** Agriculture Canada, Ottawa, ON (Canada). Communications Branch. 1985. 106p. (MICROLOG–89-03698). Available from PC Agriculture Canada, Communications Branch, Sir John Carling Bldg., Carling Ave., Ottawa, ON, CAN K1A 0C5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

This publication discusses farm energy management, how energy costs can be reduced by at least 10% on most farms, and discusses some of the opportunities and pitfalls of renewable enrgy use on the farm. Material for the publication was compiled from a review of technical journals, farm magazines, extension factsheets, and research reports. Selected references are listed for each subject discussed. Coverage includes farmstead planning, the farm home, transportation, equipment management, crop production, livestock production, and renewable energy such as solar, wind, water , wood gasifiers, use of crop residues, anaerobic digestion of manure, alcohol potenital from farm crops, and vegetable oils for diesel engines. A list of energy units, and the addition to farming costs of a rise in the cost of curde oil by $1.00 per barrel are also given. 139 figs., 3 tabs.

5354 (CONF-891208–7) **Recent advances an magnetic heat pump technology.** Uherka, K.L. (Argonne National Lab., IL (USA)); Hull, J.R.; Scheihing, P.E. Argonne National Lab., IL (USA). [1989]. 20p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From Winter annual meeting of the American Society of Mechanical Engineers; San Francisco, CA (USA); 10-15 Dec 1989. Order Number DE89013289. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Magnetic heat pump (MHP)/refrigeration systems, incorporating state-of-the-art superconducting magnet technology, have been assessed for industrial applications ranging from the liquefaction of gases (20°K to 100°K range) to cold storage refrigeration for food preservation (250°K to 320°K range). Initial market penetration of MHP technology is anticipated to occur in the gas liquefaction sector, since the performance advantages of magnetic refrigeration cycles relative to gas compression cycles and other conventional systems are more pronounced in the lower temperature ranges. Design options for rotary MHP devices include alternative regeneration schemes to obtain the temperature spans necessary for industrial applications. The results of preliminary design assessment studies indicate that active magnetic regenerator concepts, in which the magnetic working material also serves as the regenerative medium, offer advantages over alternative MHP designs for industrial applications. 20 refs., 2 figs.

5355 (DOE/CE/40625–T1) **Intelligent process control systems for materials heat treatment.** National Research Council, Washington, DC (USA). Commission on Engineering and Technical Systems. 1989. 41p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC01-84CE40625. (NMAB–457). Order Number DE90003663. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report on the application of intelligent process control systems for materials heat treatment is the result of the deliberations of the NMAB Industrial Energy Conservation Committee and is based largely on the results of a workshop held by the committee on January 10–11, 1989. The committee concluded that intelligent process control systems are important to the future of the heat treating industry and they can conserve energy while enhancing industry competitiveness. Specific recommendations for R and D that should be funded by government are included in the report because, in the committee's judgment, the structure of the industry and the limited sales volume restrict its incentives to undertake the work by itself. The committee also concluded that intelligent process control system developments can have a much greater impact in other industries than just in heat treating as the applications expand. 8 refs.

5356 (DOE/CE/40806–T2) **Energy management assistance for small and medium-size manufacturers: Manufacturers' evaluations of EADCs' services, 1988–1989.** Reeder, K.M.; Kirsch, F.W. University City Science Center, Philadelphia, PA (USA). Oct 1989. 34p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FC01-87CE40806. Order Number DE90003440. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Small and medium-size manufacturers continue to express strong confidence in and satisfaction with the energy-conserving and cost-saving services provided by the Energy Analysis and Diagnostic Centers. That conclusion is based upon in-depth interviews with 227 of the 340 manufacturers (67%) served during 1988-89 by an EADC. These interviews were conducted at the manufacturing plants by engineers from the Industrial Technology and Energy Management (ITEM) division of University City Science Center, which manages the EADC program under agreement with the Office of Industrial Programs, US Department of Energy. University engineering faculty and a mix of graduate and undergraduate students who make up the staff of each EADC perform energy audits under subcontract to the Science Center at manufacturing plants which are located within about 150 miles of the university. This report presents the chief results obtained during two series of interviews with 67% of the manufacturers in 36 states served by 13 EADCs during 1988-89. These include the principal benefits derived by the manufacturers, the extent to which EADCs' recommendations are being understood and implemented, and the manufacturers' perceptions about the ways EADCs carry out their dual mission of industrial service and educational enrichment.

5357 (DOE/ID/12711–1) **Assessment and development of an industrial wet oxidation system for burning waste and low-grade fuels: Final report.** Stone and Webster Engineering Corp., Boston, MA (USA). Sep 1989. 313p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FC07-88ID12711. Order Number DE90003403. Available from NTIS, PC A14/MF A01 - OSTI; GPO Dep.

The DOE Office of Industrial Programs, through the Idaho Operations Office, is sponsoring a program to develop and eventually demonstrate a wet oxidation system for energy production from water borne industrial waste materials and/or low-grade fuels for use in industrial processes. This program is considered a natural extension of previous DOE studies which have evaluated energy production through the wet oxidation of coal and peat. While the results of these studies were favorable for large-scale power generation, the Office of Industrial Programs believes that wet oxidation also has the potential to displace prime fuels on a smaller scale through the treatment of industrial wastes or other low-grade fuels. This report summarizes the feasibility of this program.

5358 (EGG-M–89039) **Waste heat recovery.** Harkins, B.D. (Solar Turbines, Inc., San Diego, CA (USA)); Ward, M.E. EG and G Idaho, Inc., Idaho Falls, ID (USA); Solar Turbines, Inc., San Diego, CA (USA). [1989]. 16p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC07-76ID01570;FC07-88ID12799. (CONF-891208–15: Winter annual meeting of the American Society of Mechanical Engineers, San Francisco, CA (USA), 10-15 Dec 1989). Order Number DE89016359. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Solar Turbines Incorporated (Solar) is currently participating with the Department of Energy (DOE, Idaho) to develop a High Pressure Heat Exchange System (HiPHES), capable of heating compressed air, 1034 KPa abs (150 psia) to a temperature of 871°C (1600°F). The operating environment for the air heater will be a hazardous waste incinerator with a gas stream temperatures inexcess of 1260°C (2300°F). The air heater being design for this project is modular and composed of monolithic and composite ceramics components. The HiPHES air heater being developed by Solar will be integrated into an indirectly heated gas turbine cycle as a method of generating electric power from waste heat gas stream. A project

overview is presented, with an emphasis on ceramic component design. 7 refs., 15 figs., 5 tabs.

5359 (KCP–613-4145) **A strategy for concurrent product and process design of aerospace components.** Brewer, D.H. (Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div.); Sherif El-Gizawy, A.; Hwang, Jeng-Yih. Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div. Jul 1989. 22p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00613. (CONF-891208–24: Winter annual meeting of the American Society of Mechanical Engineers, San Francisco, CA (USA), 10-15 Dec 1989). Order Number DE90002926. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A strategy is presented for concurrent product and process design of aerospace components that require high strength and light weight. A modular modeling technique that combines physical and computer models was developed to implement the concurrent product and process design approach. The strategy provides for timely evaluation of the product and process design changes on manufacturing performance as measured by cost effectiveness and productivity indices. Implementation of the strategy is illustrated by a case study from the aerospace industry. Three different product designs for manufacture were tested with eight different processing conditions. The selected processes included conventional hot forging coupled with heavy machining, net-shape forming, and near-net-shape forming plus finish machining. The results indicated that the product and preform geometries, interface friction condition, and speed of deformation used design parameters that could be optimized to reduce costs and improve productivity. The study illustrates clearly the advantage of the strategy realized through reduction of lead time and development costs for product, process, and tooling. 14 refs., 12 figs., 1 tab.

5360 (PB–89-235170/XAB) **Advanced energy-system program. Second annual report, March 1987-October 1988.** Allied-Signal Aerospace Co., Torrance, CA (USA). AiResearch Los Angeles Div. Feb 1989. 109p. (DOC–89-62095). Available from NTIS, PC A06/MF A01.

See also PB–88-183025.

The objectives of the program are to design, develop and demonstrate a natural-gas-fueled, highly recuperated, 50-kW Brayton-cycle cogeneration system for commercial, institutional, and multifamily-residential applications. Marketing studies have shown that this Advanced Energy System (AES), with its many unique and cost-effective features, has the potential to offer significant reductions in annual electrical and thermal energy costs to the consumer. Specific advantages of the system that result in low cost of ownership are high electrical efficiency (30%, HHV), low maintenance, high reliability, and long life (20 years).

5361 (PB–89-235972/XAB) **Summary of annual reports on hazardous waste for 1984 through 1987: Generation, treatment, storage, and disposal.** Wright, H.A.; Theios, E.P.; Chappel, H. Illinois Environmental Protection Agency, Springfield, IL (USA). Div. of Land Pollution Control. Dec 1988. 73p. (IEPA/LPC–89/011). Available from NTIS, PC A04/MF A01.

See also report for 1983-86, PB–88-174362.

This report is a product of Illinois' Annual Report requirements for reporting years 1984 through 1987, for hazardous waste as defined under the Resource Conservation Recovery Act (RCRA) and the comparable Illinois regulations. Several comprehensive tables are included: (A) listing by RCRA Hazardous Waste Number of the volume of waste shipped off-site by Illinois generators and the amount of waste stored, treated, or disposed by Illinois facilities; (B) listings by RCRA Hazardous Waste Number of the volume of waste handled on-site and off-site by treatment sites, landfills, incinerators, injection wells, surface impoundments and treatment/recycling; (C) listing by Illinois county of the volume of waste shipped off-site and of the volumes treated, stored, or disposed by on-site generators and by off-site facilities; (D) listing by the various states regarding waste imported into Illinois and exported from Illinois; and (E) lists of companies who reported handling over 1 million gallons of waste in 1987.

5362 (PB–89-236277/XAB) **Physically based network model for two- and three-phase saturation: Capillary pressure relationships. Final report.** Celia, M.A.; Ferrand, L.A. Massachusetts Inst. of Tech., Cambridge, MA (USA). 1989. 21p. Available from NTIS, PC A03/MF A01.

Hydrocarbon contaminants from leaky tanks and industrial-waste sites often enter the subsurface as separate nonaqueous phase liquids (NAPLs). These relatively immiscible compounds may remain in the subsurface for many years, acting as sources of pollution to ground water. Meaningful analysis of multiphase systems is currently limited by a lack of information about specific material properties. This is especially true for the vadose zone, wherein three fluid phases, two liquids and one gas, can coexist. The research performed under this USGS Grant involved development of conceptual models to simulate capillary-dominated fluid-fluid displacements at the pore scale. A general discussion of the role of constitutive equations is presented, with emphasis on multiphase flow in porous media. This is followed by an overview of the model used to represent the fluid-fluid displacement process. This is followed by a discussion of the significance of the work, and by suggestions for future research directions. Finally, a list of publications directly related to the project is presented.

5363 (PB–89-237366/XAB) **Technologies for the recovery of solvents from hazardous wastes.** Olexsey, R.A.; Blaney, B.L.; Turner, R.J.; Brown, L.M. Environmental Protection Agency, Cincinnati, OH (USA). Hazardous Waste Engineering Research Lab. 1988. 15p. (EPA–600/J-88/365). Available from NTIS, PC A03/MF A01.

Pub. in Hazardous Waste and Hazardous Materials, Vol. 5, No. 4, 365-377(1988).

About 1.5 billion gallon of hazardous waste solvents were disposed of to the land in 1985. The Hazardous and Solid Waste Amendments (HSWA) of 1984 required that EPA prohibit the direct land disposal of these materials after November 8, 1986. Alternatives to direct land disposal include source reduction, destruction, treatment, and recovery. This paper describes several technologies that can be used to recover solvent materials from hazardous wastes. Such technologies include evaporation, distillation, solvent extraction, critical fluids processing, steam and air stripping, and carbon adsorption. Data from USEPA studies are presented on recovery efficiencies for several of the unit processes.

5364 (PB–89-237978/XAB) **Assessing potential effects of incinerating organic wastes at sea: Development and field testing of the Marine Incineration Biological Assessment Sampler.** Werme, C.; Boehm, P.; Cooke, M.; Oberacker, D.; Jackson, M. Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab. 1988. 5p. (EPA–600/J-88/358). Available from NTIS, PC A02/MF A01.

Pub. in Marine Pollution Bulletin, Vol. 19, No. 11B, 602-604(1988). See also PB–88-133582.

This paper discusses the development and field-testing of the Marine Incineration Biological Assessment Sampler (MIBAS), used to assess potential effects of incinerating hazardous wastes at sea. In 1985, the U.S. EPA developed a strategy for the research necessary for measuring environmental and public health effects of incinerating hazardous wastes at sea. One area of the strategy addressed developing a way to sample incinerator emissions and introduce them into seawater for use as test media in toxicity tests. Responding to the strategy, EPA developed the MIBAS system, a system that samples incineration flue gas, cools the emissions, and collects them in seawater-filled impingers. Particulate matter and both semi-volatile and nonvolatile organic species are collected by the train. The system uses no materials that could in themselves prove toxic to marine organisms. A recent modification of the train permits collecting emissions in the first impinger without bubbling, mimicking the situation in nature, where emissions would settle onto the ocean surface. MIBAS tests have included spike recovery, using a gas-phase spiking system to spike compounds into the emissions and then measuring them in the components of the MIBAS train.

5365 (PB–89-873434/XAB) **Microwave heating: Industrial applications. September 1986-September 1989 (Citations from the COMPENDEX data base). Report for September 1986-September 1989.** National Technical Information Service,

Springfield, VA (USA). Oct 1989. 61p. Available from NTISPC N01/MF N01.

Supersedes PB–88-870142.

This bibliography contains citations concerning industrial uses and design of microwave heating equipment. Included are heating and drying of paper, industrial process heat, vulcanization, textile processing, metallurgical heat for sintering and ceramic manufacturing, food processing, and curing of polymers. (This updated bibliography contains 116 citations, 11 of which are new entries to the previous edition.)

5366 (WSRC-RP–89-792) **Predicting the performance of ceramic filters by the use of silt density index.** Cain, S.M. Westinghouse Savannah River Co., Aiken, SC (USA). [1989]. 16p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. Order Number DE90001316. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A series of experiments were conducted to study the rate of filter fouling of several simulants. These solutions contained hydroxides of iron, aluminum, silica, and zinc, using a range of concentration of each under various conditions. Total Solids (TS), Total Suspended Solids (TSS), Total Dissolved Solids (TDS), Silt Density Index (SDI), and conductivity were measured in the studies. The purpose of these experiments was to find out whether or not SDI could be used to accurately predict the performance of ceramic filters. The preliminary results show that SDI alone cannot be used, but can be used in conjunction with the total filtration time. The procedure is limited and can only be used for preliminary screening. 4 refs., 3 figs.

3206 Municipalities and Community Systems

Refer also to citation(s) 4646, 4912, 4947, 4992, 4993, 4994, 4995, 5030, 5031, 5032, 5033, 5034, 5035, 5036, 5037, 5050, 5052, 5094, 5268, 5282, 5283, 5360, 5641

5367 (ACERR–CE-02763) **Technical feasibility and cost study of programmable controller for parking lot block heater services.** Alberta/Canada Energy Resources Research Fund, Edmonton, AB (Canada). 1985. vp. (CE–02763). Available from CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: $0.34 CAN per page, $3.40 minimum.

This study examines the potential for cost savings in the operation of a parking lot in Alberta. The targeted savings are primarily in the reduction of electricity consumed by block heaters and related plug-in devices used in automobiles during winter. The proposed control strategy is the cycling of electrical power to parking receptacles based upon the ambient temperature and the time of day. The ambient temperature would have to be low enough to warrant the use of a block heater to facilitate starting automobiles during winter; parking receptacles would be energized at intervals rather than continuously. This control measure is based on the fact that block heaters do not have to be energized continuously in order to maintain the engine block temperature at an acceptable level. A programmable controller was selected to achieve the above control objectives. The use of such a controller offers the advantage of being able to initiate different power cycling patterns. In order to define the temperature thresholds to be employed at the parking lot, the information sources consulted included meteorological data, numerical studies on the optimum use of block heaters, and literature by power utilities. The power cycling periods were partly based on a survey of parking lot usage. Based on the best estimates of the average cost (energy and demand) for parking lot operation without any form of energy control, estimates of the possible savings were derived by proposing certain temperature thresholds and power cycling patterns. The cost savings are estimated at ca $10.480 annually (assuming demand cost savings are available) at a design and installation costs payback of less than 1.5 years. 4 figs.

5368 (CONF-8811198–, pp. 263-278) **Energy and the development of urban development models.** Lazzareschi, C. (AGENE Servizi, Rome (Italy)). Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica; International Solar Energy Society (ISES), Rome (Italy). Italian Section. Feb 1989. (In Italian). From Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988. In *Bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988.* Available from NTIS (US Sales Only), PC A19.

Present day urban development models, which involve mainly exogenous energy inputs (transportation of prime material and labour to development sites), create external diseconomics and environmental problems. These are therefore, on the whole, more costly than integrated development models with build-in energy conservation schemes. This paper proposes such development models based on the use of renewable energy sources (eg. solar), on the recycling of wastes (eg. biomass conversion) and integrated planning (residential/agricoltural/industrial) in which attention is given to the limitation of environmental and socio-economic impacts.

5369 (CONF-8909141–4) **Progress of the RERTR [Reduced Enrichment Research and Test Reactor] Program in 1989.** Travelli, A. Argonne National Lab., IL (USA). [1989]. 20p. Sponsored by U.S. Arms Control and Disarmament Agency; U.S. DOE Management & Administration. DOE Contract W-31109-ENG-38. From 12. international meeting on reduced enrichment for research and test reactors; Berlin (Germany, F.R.); 10-13 Sep 1989. Order Number DE90001441. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The progress of the Reduced Enrichment Research and Test Reactor (RERTR) Program is described. After a brief summary of the results which the RERTR Program, in collaboration with its many international partners, had achieved by the end of 1988, the major events, findings, and activities of 1989 are reviewed. The scope of the RERTR Program activities was curtailed, in 1989, by an unexpected legislative restriction which limited the ability of the Arms Control and Disarmament Agency to adequately fund the program. Nevertheless, the thrust of the major planned program activities was maintained, and meaningful results were obtained in several areas of great significance for future work. 15 refs., 12 figs.

5370 (CRIE-Y–88017) **Design study of undergrounding distribution facilities in urban street space.** Yamashita, Yo; Yamamoto, Kimio. Central Research Inst. of Electric Power Industry, Tokyo (Japan). Mar 1989. 44p. (In Japanese). Order Number DE90725012. Available from NTIS (US Sales Only), PC A03/MF A01.

Designs of urban street space for the distribution of facilities put on footways when electric wires are buried in the ground have a tendency to be treated comprehensively from the viewpoint of urban amenity. Recent designing street space aims at not only improving visual or spatial orderliness, but also developing economic activities or neighborhood communities. The authors investigated many design examples of urban street space to understand their characteristics, and discussed the method of designing for the distribution of facilities on footways when electric wires are buried in the ground. They made various design drafts of the distribution facilities. They classified street space designs into eight types by design purposes and characteristics of street spaces (uses of surrounding areas, widths of footways, and heights of adjacent buildings). They studied and proposed many design ways corresponding to each design type on two types of distribution facilities, pillar-box type used conventionally and pole-mounted type developed now. 11 refs., 26 figs., 6 tabs.

5371 (DOE/CE/26571–T5) **District heating and cooling at Mission Bay: Briefing paper.** San Francisco, City and County of, CA (USA). Nov 1989. 7p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract FG01-88CE26571. Order Number DE90003389. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The City of San Francisco, in cooperation with the Pacific Gas and Electric Company, and with the assistance and support of the US Department of Energy, is in the process of analyzing the technical and economic feasibility of a District Heating and Cooling System for the Mission Bay redevelopment area in San Francisco. The following gives an overview of district heating and cooling technology and describes the origins and current status of the project.

5372 (ORNL/TM–11173) **Coal-burning technologies applicable to Air Force central heating plants.** Thomas, J.F.; Young, J.M. Oak Ridge National Lab., TN (USA). Dec 1989. 103p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400. Order Number DE90004352. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

Coal-based technologies that have potential use for converting Air Force heating plants from oil- or gas-firing to coal-firing were examined. Included are descriptions, attributes, expected performance, and estimates of capital investment and operating and maintenance costs for each applicable technology. The degree of commercialization and risks associated with employing each technology are briefly discussed. A computer program containing costing algorithms for the technologies is described as an Appendix. 46 refs., 15 figs., 1 tab.

3209 Education and Public Relations

Refer also to citation(s) 5322

5373 (MMCL–89-03520) **Pro-fisher seminars.** Maritime Marine Consultants Ltd., Rothesay, NB (Canada). 1988. 58p. (MICROLOG–89-03520). Available from PC New Brunswick Dept. of Natural Resources and Energy, P.O. Box 6000, Fredericton, NB, CAN E3B 5H1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A series of seminars were held in New Brunswick to transfer information obtained in research on energy conservation in the fisheries sector. This report contains an evaluation of the effectiveness of the seminars and a final revised version of the seminar text. The text includes an introduction on energy costs and future trends as they apply to the typical fishing vessel (20 m in length or less) used in New Brunswick. Information is presented on propeller design, propeller clearances, propeller speed and loading, advantages and disadvantages of diesel engines, energy transmission systems (electrical, hydraulic, and mechanical), and how all these relate to the most efficient use of energy in the fishing vessel. 17 figs., 2 tabs.

33 ADVANCED PROPULSION SYSTEMS

3301 Internal Combustion Engines

Refer also to citation(s) 5383, 5384, 5388, 5393, 5395, 5667, 5691

5374 (DOE/AL/33183–T12) **Multi-dimensional modeling of convective heat transfer with application to I.C. engines: Final report.** Ricardo-ITI, Inc., Westmont, IL (USA). 30 Nov 1989. 9p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC04-86AL33183. Order Number DE90003245. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report summarizes the major findings of a research program in the area of convective heat transfer modeling for internal combustion engine flows. The modeling effort has been performed in the context of multi-dimensional flow calculation procedures with the following objectives: (1) develop better techniques for representing the key heat transfer phenomena in multi-dimensional calculation procedures, and (2) utilize these to develop a more comprehensive understanding of convective heat transfer in complex, unsteady, reacting flows characteristic of those found in I.C. engines. 4 refs.

5375 (NRC/ACP–89-03549, pp. 14) **Predicting the effects of progressive compressor fouling on gas turbine performance.** Aker, G.F. (Carleton Univ., Ottawa, ON (Canada)); Saravanamuttoo, H.I.H. National Research Council of Canada, Ottawa, ON (Canada). Associate Committee on Propulsion. Sep 1987. (CONF-8709481–: 7. National Research Council of Canada (NRCC) symposium on industrial application of gas turbines, Banff (Canada), 27-30 Sep 1987; MICROLOG–89-03549). In *Proceedings [of the] seventh NRCC [National Research Council of Canada] symposium on industrial application of gas turbines.* Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A computer simulation program was developed employing the stage stacking technique in an effort to quantify the effects of compressor fouling on gas turbine performance. By matching the compressor maps generated by the simulation software to generalized turbine characteristics, the effect of progressive compressor fouling on several operating parameters was predicted. The results of these simulations can be used to correlate changes observed in monitored parameters, to changes in heat rate and power output, thus allowing the user to determine the most economical interval between compressor washes. The engine used in the simulation was the 2860 kW Solar Centaur T-4000. Results compared favorably to those obtained at a test performed at a compressor station in Alberta. 10 refs., 11 figs., 1 tab.

5376 (NRC/ACP–89-03549, pp. 20) **A critical assessment of the application of artificial intelligence to engine health monitoring.** MacIsaac, B.D. (GasTOPS Ltd., Ottawa, ON (Canada)). National Research Council of Canada, Ottawa, ON (Canada). Associate Committee on Propulsion. Sep 1987. (CONF-8709481–: 7. National Research Council of Canada (NRCC) symposium on industrial application of gas turbines, Banff (Canada), 27-30 Sep 1987; MICROLOG–89-03549). In *Proceedings [of the] seventh NRCC [National Research Council of Canada] symposium on industrial application of gas turbines.* Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The fundamental elements of artificial intelligence are examined in this paper. A brief description of the current state of the art is provided based on available literature. The application of artificial intelligence in the form of expert systems is explored and specific prerequesites to the successful application of these techniques are defined. Finally, an examination of how well the various techniques used in the monitoring of gas turbines meet these prerequesites is explored and conclusions are drawn about the applicability of artificial intelligence to this field. It is concluded that only conventional event records of troubleshooting decision trees meet all of the prerequesites for applicability of artificial intelligence. Vibration monitoring and gas path analysis require substantial development of the knowledge base before artificial intelligence methods can be applied. Boroscoping and several oil monitoring techniques require human visual perception to be effective. Mechanical and thermal fatigue counters are currently inappropriate for artificial intelligence methods. 13 refs., 3 figs., 1 tab.

5377 (NRC/ACP–89-03549, pp. 9) **New or replacement power with the first third generation aero-derived gas turbine.** Rogers, G.N. National Research Council of Canada, Ottawa, ON (Canada). Associate Committee on Propulsion. Sep 1987. (CONF-8709481–: 7. National Research Council of Canada (NRCC) symposium on industrial application of gas turbines, Banff (Canada), 27-30 Sep 1987; MICROLOG–89-03549). In *Proceedings [of the] seventh NRCC [National Research Council of Canada] symposium on industrial application of gas turbines.* Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This paper discusses the basic philosophy of those industrial gas turbines derived from aircraft industry technology, and their place in the techno-economic engineering matrix. One specific design involves the aircraft-derived General Electric LM1600 gas generator coupled with a turbine derived directly from the Dresser-Rand E-232 fluidic catalytic cracker unit power recovery expander to form the Dresser-Rand GT-60 gas turbine. Performance characteristics are given, showing the possibility for significant fuel savings when used as a gas compressor power source in pipeline applications. By replacing an earlier-generation turbine with the latest model, and operating at full load conditions for 8000 h/y, a cost saving of $1 million per year (at a fuel gas cost of $3.00 per million BTU) is

calculated. Additional advantages in replacing older turbines are related to such design factors as state-of-the-art inlet systems that keep the compressor clean and free from fouling, improved control systems, and use of dry gas seals and magnetic bearings that reduce parasitic losses and contamination. 4 figs.

5378 (NRC/ACP–89-03549, pp. 10) **Uprating of Cooper-Bessemer RT48 power turbine for Rolls-Royce Avon gas generators.** Meier, R.H. (Cooper-Bessemer Rotating Products, Mount Vernon, OH (USA)). National Research Council of Canada, Ottawa, ON (Canada). Associate Committee on Propulsion. Sep 1987. (CONF-8709481–: 7. National Research Council of Canada (NRCC) symposium on industrial application of gas turbines, Banff (Canada), 27-30 Sep 1987; MICROLOG–89-03549). In *Proceedings [of the] seventh NRCC [National Research Council of Canada] symposium on industrial application of gas turbines.* Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The design modifications performed over the years to a widely used gas power turbine, whose design combines aspects of aircraft and industrial technologies, are reviewed. Since the first design in 1959, five major upratings have occurred. Mechanically, these have involved material improvements to accommodate higher temperatures, and the addition of disk cooling. Aerodynamically, the changes have involved primarily the restaggering of the first stage stator vane to match changing gas generator operating lines. The overall power has increased from 7,830 kW in 1959 to 15,060 kW in 1987. Thermal efficiency has increased in that same period from 25.4 to 29.7%. 3 figs., 2 tabs.

5379 (NRC/ACP–89-03549, pp. 11) **Avon series and Cooper RT48s upgrade.** Handy, P.J. (Rolls Royce Canada Ltd., Montreal, PQ (Canada)); Meier, R.H. National Research Council of Canada, Ottawa, ON (Canada). Associate Committee on Propulsion. Sep 1987. (CONF-8709481–: 7. National Research Council of Canada (NRCC) symposium on industrial application of gas turbines, Banff (Canada), 27-30 Sep 1987; MICROLOG–89-03549). In *Proceedings [of the] seventh NRCC [National Research Council of Canada] symposium on industrial application of gas turbines.* Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The Rolls-Royce Avon gas turbine has shown reliable, proven performance in industrial applications. Changing market forces, demanding improved efficiency, have led to design changes intended to improve the Avon's thermal efficiency within existing constraints of price, reliability, and interchangeability. The design features contained within the efficiency conversion kit, applicable to existing Avons, and within new production engines are summarized. These include polishing of rotor and stator blades, changing the material in thrust bearing, and new alloys used in turbine blades. Data are presented to illustrate the performance improvements over the unmodified turbines. 4 figs., 3 tabs.

5380 (NRC/ACP–89-03549, pp. 19) **Technology trends in aircraft gas turbines and their industrial applications.** Sampath, S.P. (Pratt & Whitney Canada, Mississauga, ON (Canada)). National Research Council of Canada, Ottawa, ON (Canada). Associate Committee on Propulsion. Sep 1987. (CONF-8709481–: 7. National Research Council of Canada (NRCC) symposium on industrial application of gas turbines, Banff (Canada), 27-30 Sep 1987; MICROLOG–89-03549). In *Proceedings [of the] seventh NRCC [National Research Council of Canada] symposium on industrial application of gas turbines.* Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Technology trends in small aviation gas turbine engines are presented, which have been dictated by demands for improved performance and lower operating costs. Some of the technologies will find application in future industrial gas turbines used in pipeline and energy sectors. Canadian research activities in gas turbine component fields such as compressors, turbines, combustors, and materials are reviewed briefly. Application of technology advancements to new engine design is examined in relation to Pratt & Whitney Canada's new PW100 engine. The potential for industrial application of PW100 is described. 8 refs., 17 figs., 7 tabs.

5381 (UCRL–102147) **Comparison of engine knock predictions using a fully-detailed and a reduced chemical kinetic mechanism.** Cowart, J.S. (Massachusetts Inst. of Tech., Cambridge, MA (USA)); Keck, J.C.; Heywood, J.B.; Westbrook, C.K.; Pitz, W.J. Lawrence Livermore National Lab., CA (USA). 13 Oct 1989. 62p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-7405-ENG-48. (CONF-8910289–1: Western States Section meeting of the Combustion Institute, Livermore, CA (USA), 23-24 Oct 1989). Order Number DE90002805. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Two different chemical kinetic models are used to interpret engine knock data obtained in a laboratory internal combustion engine. These consisted of a detailed chemical kinetic model and a global kinetic model, both calibrated to be able to describe these conditions. Both models are found to provide accurate simulations of the experimental data, but both models required calibration and/or updating. The comparisons of both models with experimental results are discussed, and the two models are compared together. The relationships between the detailed kinetic model and the global reaction steps intended to simulate those steps examined in detail, and the relative strengths and weaknesses of the two approaches are discussed. 28 refs., 8 figs., 5 tabs.

5382 **Coherent anti-Stokes Raman scattering measurements in a spark ignited internal combustion engine.** Rakestraw, D.J. (Sandia National Labs., Albuquerque, NM (USA)); Green, R.M.; Lucht, R.P.; Tack, L.; Dreier, T. pp. 443 of OSA conference on lasers and electro-optics (1989 Technical Digest series). Optical Society of America, Washington, DC (1989). (CONF-890423–: CLEO '89: conference on lasers and electro optics, Baltimore, MD (USA), 24-28 Apr 1989).

Technical Paper THE2.

Broadband coherent anti-Stokes Raman scattering (CARS) measurements of the unburned gas temperature in a spark ignition internal combustion engine have been performed. Previously, CARS measurements of nitrogen spectra were used to determine the unburned gas temperature in a knocking engine using butane as the fuel. The authors made measurements of the unburned gas temperature histories just prior to autoignition for several different fuels with and without proknock additives. A typical nitrogen CARS spectrum obtained in the unburned gas is shown. They find that the accuracy and reproducibility of their measurements have improved by using the CCD as the detector for the CARS signals. Temperature measurements have also been made in the burned gases near the chamber wall. A nitrogen CARS spectrum in the burned gases is shown. The signal quality is sufficient to provide good spectral fits and accurate temperature determinations. The measurement of thermal boundary layers in engines are extremely important because of heat transfer and pollutant emission considerations. Initial measurements are extended to a variety of engine conditions. The effects of swirl and knock on the formation of thermal boundary layers are discussed.

3303 Electric-Powered Systems

Refer also to citation(s) 5225

3307 Emission Control

Refer also to citation(s) 4695

5383 (ORF–TE-87-12, pp. 158-169) **Diesel particulate control: Emerging control technologies to address a serious pollution problem.** Bertelsen, B.I. (Manufacturers of Emission Controls Association). Ontario Research Foundation, Sheridan Park, ON (Canada). Sep 1987. (CONF-870690–: 3. Windsor workshop on alternative fuels, Windsor (Canada), 24-26 Jun 1987; CE–02782). In

Proceedings of the third Windsor workshop on alternative fuels. Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: N/C.

Particulates from diesel motor vehicles pose a serious threat to the health and welfare of the public. Particulate emission standards adopted to date by the U.S. Congress and by the State of California are listed. Diesel particulate trap oxidizers offer a technological solution to controlling diesel particulates. The working of trap oxidizers, the choice of the filter material, the regeneration system and the controls which being about regeneration are discussed. The effects of trap oxidizers on engine and vehicle performance are presented; pollution abatement (gaseous and particulate pollutants), effects on fuel efficiency, vehicle operation and maintenance. Trap oxidizer development and retrofitting for light and heavy duty vehicles is discussed. In conclusion, the significant program which occurred in developing trap oxidizer technology is a direct result of technology-forcing standards established by the U.S. Environmental Protection Agency and by the State of California. 1 tab.

5384 (ORF–TE-87-12, pp. 313-320) **[Diesel engine emission research].** Baranescu, R.A. (Navistar International, Melrose Park, IL (USA)). Ontario Research Foundation, Sheridan Park, ON (Canada). Sep 1987. (CONF-870690–: 3. Windsor workshop on alternative fuels, Windsor (Canada), 24-26 Jun 1987; CE–02782). In *Proceedings of the third Windsor workshop on alternative fuels.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: N/C.

This paper describes research conducted at Navistar on the subject of sulfur influence on diesel particulate emissions. Data for 2 types of diesel engines show a reduction of 0.08 or 0.07 g/bhp-hr when the sulfur content of the fuel is reduced from 0.25% (average in the USA and Canada) to 0.05% (South Coast basin of California). Results obtained on other motors confirm the increase of total particulates with the sulfur content of the fuel, through the slopes of the correlations are different. The results available show that 20% of the particulate emissions consist of sulfate and bound water at a 0.25% sulfur content of the fuel. The removal of sulfur from diesel fuels would reduce engine wear, increase the choice in selecting a catalyst for diesel emissions control, and reduce the amount of sulfur dioxide emitted by diesel engines. 3 figs., 1 tab.

5385 (PB–89-229843/XAB) **Feasibility and cost-effectiveness of controlling emissions from diesel engines in rail, marine, construction, farm, and other mobile off-highway equipment. Final report.** Weaver, C.S. Radian Corp., Sacramento, CA (USA). Feb 1988. 146p. (DCN–87-258-012-25-02). Available from NTIS, PC A07/MF A01.

Diesel engines in off-highway vehicles and other off-highway mobile equipment, while less numerous than those in highway trucks and buses, are still significant contributors to oxides of nitrogen (NOx) and particulate inventories in many urban areas. These engines are presently exempt from any emissions-control requirements. Consequently, they produce far more pollution per unit of fuel input or work output than the otherwise similar emission-controlled engines used in on-highway vehicles. The recent promulgation of stringent NOx and particulate emission standards for diesel engines in on-highway vehicles has drawn attention to diesel emissions in general, and has raised the question of whether similar emissions standards might be appropriate for off-highway diesel engines.

5386 (PB–89-230676/XAB) **Derivation of technology specific effects of the use of oxygenated fuel blends on motor-vehicle exhaust emissions. Technical report.** Environmental Protection Agency, Ann Arbor, MI (USA). Emission Control Technology Div. Oct 1988. 39p. (EPA/AA/TSS/PA–88/1). Available from NTIS, PC A03/MF A01.

This report is a supporting document to the report, 'Guidance on estimating motor vehicle emission reductions from the use of alternative fuels and fuel blends.' It presents the data and calculations used to estimate the effects of gasoline/oxygenate fuel blends on vehicle exhaust emissions. Data were gathered from several studies of fuel blends, and include tests of blends with methanol, ethanol, tert-butyl alcohol, and MTBE. Effects are calculated separately for vehicles with different emission-control technology. The report discusses exhaust emissions of hydrocarbons, carbon monoxide, and oxides of nitrogen.

5387 (PB–89-230700/XAB) **MOBILE4 oxygenated-fuels version user's guide. Technical report.** Glover, E.L. Environmental Protection Agency, Ann Arbor, MI (USA). Technical Support Staff. Aug 1989. 8p. (EPA/AA/TSS/IM–89/1). Available from NTIS, PC A02/MF A01.

See also PB–88-169594.

This document briefly describes changes made to the standard MOBILE4 emission factors program to create a special version that facilities modeling the effect of the use of oxygenated fuel on carbon monoxide (CO) emissions from mobile sources. The document also explains the changes made to the MOBILE4 input and output formats to allow user input of oxygenated-fuel use. Finally, examples of input and output files for the model are provided.

5388 (PB–89-237473/XAB) **Influence of ambient temperature on tailpipe emissions from 1984-1987 model year light-duty gasoline motor vehicles.** Stump, F.; Tejada, S.; Ray, W.; Dropkin, D.; Black, F. Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab. 1989. 16p. (EPA–600/J-89/019). Available from NTIS, PC A03/MF A01.

Pub. in Atmospheric Environment, Vol. 23, No. 2, 307-320(1989).

Motor-vehicle emissions are sensitive to a number of variables including ambient temperature, driving schedule (speed versus time), and fuel composition. Hydrocarbon, aldehyde, carbon monoxide, and oxides of nitrogen emissions were examined with nine recent technology 4-cylinder gasoline motor vehicles at 70F, 40F, and 20F. About 200 hydrocarbon and 12 aldehyde compounds were included in the organic emissions characterization. Two fuels and two driving schedules were used. Typically, hydrocarbon and carbon monoxide emissions were significantly increased by reduced ambient temperature. Oxides of nitrogen emissions also increased, but to a lesser extent. There were no predictable formaldehyde emissions trends with temperature. Paraffinic and aromatic hydrocarbon emission fractions were sensitive to fuel composition, but the olefinic emission fraction (dominated by ethylene and propylene) was not. With low temperature cold start tests, preceding transient driving with a 5 minute engine idle resulted in reduced carbon monoxide emission rates and elevated oxides of nitrogen emission rates. Hydrocarbon emission rates were not predictable sensitive to the preliminary idle.

3308 Alternative Fuels

Refer also to citation(s) 4913, 5386, 5387

5389 (ORF–TE-87-12) **Proceedings of the third Windsor workshop on alternative fuels.** Ontario Research Foundation, Sheridan Park, ON (Canada). Sep 1987. 348p. (CONF-870690–: 3. Windsor workshop on alternative fuels, Windsor (Canada), 24-26 Jun 1987; CE–02782). Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: N/C.

This workshop is an informal discussion of the latest developments, trends and activities in view of various alternative fuel strategies. Methanol, natural gas, propane, and petroleum distillates are considered for their application in various types of vehicles, especially city buses and locomotives. The aspects studied are performance, economics and pollution, especially particulates pollution from diesel engines. Pollution abatement, ignition quality, and ignition enhancers derived from biomass are also studied. Separate abstracts have been prepared for 7 papers.

5390 (ORF–TE-87-12, pp. 29-46) **Canadian Gas Association(CGA) and Gas Research Inst. natural gas vehicle research and development program plans.** Heenan, J.S. (Canadian Gas Association, Mississauga, ON (Canada)); Ingle, W.D. III; Hilyare, J.F. Ontario Research Foundation, Sheridan Park, ON (Canada). Sep 1987. (CONF-870690–: 3. Windsor workshop on alternative fuels, Windsor (Canada), 24-26 Jun 1987; CE–02782). In *Proceedings of the third Windsor workshop on alternative fuels.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: N/C.

Operating economics and, particularly in the USA, environmental regulatory actions represent positive market forces favoring natural gas as a vehicle fuel. Both in Canada and in the USA, research and development are under way so as to make natural gas competitive with the established petroleum fuels, so as to retrofit existing motors to natural gas, and so as to develop natural gas versions of heavy-duty diesel engines. This paper outlines briefly the activities embraced by the Canadian Gas Association National Gas Vehicle Research and Development Fund and the means used to integrate these research and development activities with commercial demonstrations and market development. This $8M fund covers a 3-year period and expects to attract another $4M from outside agencies and interested partners. The transportation sub-sectors that are being addressed include: urban transit buses; intra-city class 6,7,and 8 trucks; secondary and tertiary railways, automotive/passenger carrying ferries; mid-sized automobiles, light trucks; and school buses. The paper also provides a summary of the US Gas Research Institute research and development activities on natural gas vehicles; high pressure metering, adsorption storage, and systems and cylinder inspection techniques. All these projects are being coordinated so as to provide a North American initiative in this field. 1 tab.

5391 (ORF–TE-87-12, pp. 202-212) **The economics of using gaseous fuels in buses.** Duncan, R.W.; Jenkins, W.D.; Webb, R.F. Ontario Research Foundation, Sheridan Park, ON (Canada). Sep 1987. (CONF-870690–: 3. Windsor workshop on alternative fuels, Windsor (Canada), 24-26 Jun 1987; CE–02782). In *Proceedings of the third Windsor workshop on alternative fuels.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: N/C.

The rationale of this demonstration program was to develop operational experience and cost data on the use of gaseous fuels in buses to prepare for in the event of fuel supply or fuel cost problems or for an enhancement of vehicle pollution standards. Other objectives were to improve comfort and ridership, and to replace oil with low-cost surplus gas and propane. Ottawa Carleton buses received a new engine adapted to propane and Hamilton buses received a new engine adapted to compressed natural gas. Fuel consumption is presented as a function of engine type; it shows an economic advantage for natural gas and propane in terms of energy consumption and of cost. The problem of pollution by nitrogen oxides was not solved. Among the factors affecting savings on conversion of city buses to these new fuels are refuelling, tax and other government incentives, reliability, and payload. Pay-back periods are calculated for the conversion of existing buses and for the acquisition of new buses with pollution control devices. 3 figs., 3 tabs.

5392 (ORF–TE-87-12, pp. 224-248) **Broad specification distillate fuels for medium-speed diesel engines.** Wakenell, J.F. (Southwest Research Inst.). Ontario Research Foundation, Sheridan Park, ON (Canada). Sep 1987. (CONF-870690–: 3. Windsor workshop on alternative fuels, Windsor (Canada), 24-26 Jun 1987; CE–02782). In *Proceedings of the third Windsor workshop on alternative fuels.* Available from Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: N/C.

A synopsis of the accomplishments of the Broadened Specification Distillate Fuels studies performed for the Association of American Railroads is provided in this paper. The fuels discussed are distillate petroleum products or blends that do not meet the American Society for Testing of Materials number 2D specification. A wide range of such petroleum products were explored as potential low cost substitutes for railroad diesel fuel. Fuels with cetane numbers above 28 have been essentially equal to No. 2 diesel fuel in efficiency and power output. Knocking was evident at cetane numbers below 30, which may result in long-term durability problems. Wet deposits in the exhaust manifold of the General Electric engine were shown to be a function of distillation temperature; no correlation could be developed concerning deposits in the EMD engine. Slides used in this presentation are included. 3 figs., 6 tabs.

5393 (PB–89-230692/XAB) **Cold starting a neat methanol (M100) vehicle with long-duration spark ignition. Technical report.** Bruetsch, R.I. Environmental Protection Agency, Ann Arbor, MI (USA). Jun 1989. 24p. (EPA/AA/CTAB–89/05). Available from NTIS, PC A03/MF A01.

A test program was devised at EPA's Motor Vehicle Emission Laboratory to evaluate the Nissan long-duration spark-ignition (LDSI) system on an M100 test vehicle to determine whether cold starting neat methanol at low ambient temperatures can be improved. Modifications were made to the vehicle's ignition system and stock cold-start injectors were utilized. Successful cold starts were obtained down to 20 F.

5394 (PB–89-235196/XAB) **Experimental and computational study of combustion limits in natural-gas-fueled internal combustion engines. Annual report, May 1988-April 1989.** Ronney, P.D. Princeton Univ., NJ (USA). Dept. of Mechanical and Aerospace Engineering. May 1989. 39p. Available from NTIS, PC A03/MF A01.

The objective of this research is to study the mechanisms of flame propagation and combustion limits relevant to natural-gas-fueled internal combustion engines. The report summarizes the progress of work performed during the first year of a two-year grant from GRI.

5395 (UCRL–101594) **An experimental and kinetic modeling study of the combustion of n-butane and isobutane in an internal combustion engine.** Wilk, R.D. (Union Coll., Schenectady, NY (USA)); Addagarla, S.; Miller, D.L.; Cernansky, N.P.; Pitz, W.J.; Westbrook, C.K.; Green, R.M. Lawrence Livermore National Lab., CA (USA). 13 Oct 1989. 45p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-7405-ENG-48;AC04-76DP00789;FG04-87AL44658. (CONF-8910289–4: Western States Section meeting of the Combustion Institute, Livermore, CA (USA), 23-24 Oct 1989). Order Number DE90002768. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Butane is the simplest alkane fuel for which more than a single structural isomer is possible. In the present study, n-butane and isobutane are used in a test engine to examine the importance of molecular structure in determining knock tendency, and the experimental results are interpreted using a detailed chemical kinetic model. A sampling valve was used to extract reacting gases from the combustion chamber of the engine operated in a skip-fire mode. Samples were withdrawn at different times during the skip cycles, providing a measure of the concentrations of a wide variety of reactant, olefin, carbonyl, and other intermediate and product species. The chemical kinetic model predicted the formation of all the intermediate species measured in the experiments. The agreement between the measured and predicted values is mixed and is discussed. Calculations show that RO_2 isomerization reactions are more important contributors to chain branching in n-butane oxidation is dependent on H-atom abstraction reactions involving HO_2 and CH_3O_2 radicals that occur at higher temperatures than RO_2 isomerization reactions. Therefore, an isobutane mixture must be raised to a higher temperature than a n-butane mixture to achieve the same overall rate of reaction. 48 refs., 3 figs., 2 tabs.

5396 (UCRL–102001) **Shock tube ignition of octanes.** Burcat, A. (Technion-Israel Inst. of Tech., Haifa (Israel). Faculty of Aerospace Engineering); Pitz, W.J.; Westbrook, C.K. Lawrence Livermore National Lab., CA (USA). 27 Sep 1989. 60p. Sponsored by U.S. DOE Conservation & Renewable Energy; U.S. DOE Energy Research; United States-Israel Binational Science Foundation. DOE Contract W-7405-ENG-48. (CONF-8910289–3: Western States Section meeting of the Combustion Institute, Livermore, CA (USA), 23-24 Oct 1989). Order Number DE90001167. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Ignition delay time measurements were carried out behind reflected shock waves for three isomeric forms of octane, including n-octane, 2,2,4-trimethyl pentane (iso-octane), and 2,3,4-trimethyl pentane, as well as for 1-octene. The initial concentrations of fuel, oxygen, and argon, and the initial post-shock temperature were varied systematically in order to establish the influences of these parameters on the ignition delay time. A detailed chemical kinetic reaction mechanism was then developed to interpret the experimental results. The overall agreement between experimental and computed results was very good, and the model was then used to explain, in detailed kinetic terms, the elementary reaction paths by which each of these fuels ignite and the kinetic differences between these closely related hydrocarbon fuels. 38 refs., 25 figs., 6 tabs.

35 ARMS CONTROL

3501 Policy, Negotiations, and Legislation

Refer also to citation(s) 5262

5397 (AD-A–211349/6/XAB) **NATO (North Atlantic Treaty Organization) deterrence and defense after the INF (Intermediate-Range Nuclear Forces) treaty. Final report, June 1988–June 1989.** Garrett, S.A. Naval Postgraduate School, Monterey, CA (USA). 21 Jun 1989. 112p. (NPS–56-89-010). Available from NTIS, PC A06/MF A01.

The treaty between the Soviet Union and the United States eliminating a whole class of intermediate-range nuclear forces (INF) in Europe raises a number of questions about NATO's future ability to deter Warsaw Pact aggression. Future choices on Alliance strategy and doctrine will be influenced by a variety of factors, including the image of new thinking in Soviet security policy enunciated by General Secretary Gorbachev, changing West European opinion toward the use of nuclear weapons for NATO deterrence, the complications inherent in further nuclear and conventional arms-control negotiations, assessments of the current conventional arms balance in Europe, and ongoing questions about NATO cohesion as well as the continued coupling of American security with that of her European allies. In the post-INF environment it may well be that U.S. Navy nuclear assets will assume an increasingly important role, particularly the Tomahawk Land Attack Missile/Nuclear (TLAM/N). The TLAM/N has many attractive attributes that can be supportive of NATO deterrence of the WTO, but there are also a number of unresolved questions to be addressed concerning this particular weapons system. Modernization of NATO's land-based short-range nuclear forces (SNF), such as the Lance missile, is also seen by many as critical to the maintenance of Alliance security in the aftermath of INF.

5398 (LA-UR–89-3684) **Prospects for space arms control.** Pilat, J.F. Los Alamos National Lab., NM (USA). 1989. 7p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-8909272–1: Research in air space law symposium, Montreal (Canada), Sep 1989). Order Number DE90003392. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

At the recent Wyoming Ministerial, US Secretary of State Baker and Soviet Foreign Minister Shevardnadze signed a memorandum of understanding on a bilateral verification experiment and data exchange related to a prohibition on chemical weapons, an agreement on advance notification of certain strategic exercises, and an umbrella agreement on START trial verification and stability measures. Despite these substantive achievements in high priority areas for the United States and the Soviet Union, media attention on the ministerial focused on an offer by the Soviets that would allow a START agreement to be concluded without a resolution of US-Soviet differences in the Defense and Space (D & S) talks. Of course, the Soviet offer did not "delink" START and D & S, because the Soviets continued to demand the right to withdraw from START if the United States deployed space-based defenses. A more substantial proposal on Defense and Space was the US initiative inviting a group of Soviet experts to visit Los Alamos and the TRW Corporation's test facility in San Juan Capistrano to learn more about US SDI research activities. The US invitation was proposed in the context of the Predictability Measures Protocol to a Defense and Space Treaty, tabled by the United States, which calls for regular exchanges of data, briefings, visits to laboratories, and observation of tests designed to foster transparency and predictability.

5399 **Speculations on a defense-dominated world.** Weinberg, A.M. (Inst. for Energy Analysis, Oak Ridge Associated Universities (US)). vp of Strategic defenses and arms control. Weinberg, A.M.; Barkenbus, J.N Paragon House Pubs., New York, NY (1988).

Since reprocessing today is so expensive, a proscription on reprocessing plants makes economic sense: economics now makes proliferation through diversion of plutonium very dear. Nevertheless, Japan and West Germany, both non-weapons states, have proceeded with reprocessing plants. Although economics today pushes the nuclear enterprise away from the use of separated plutonium, in the long run, as raw uranium becomes scarce, reprocessing will again make economic sense. One cannot depend on economics alone always to ensure that response time will be long enough to settle underlying disputes before opponents resort to nuclear war. Though the Carter proposal is aimed at controlling proliferation, not at avoiding spasmodic war, the author finds it significant that the underlying strategy - lengthening response time - is implicit also in Dysons's strategy for preventing a cataclysmic nuclear exchange. Both Dyson's and Schell's worlds renounce tactical nuclear war. For them, as for many other stratagists, a limited tactical nuclear war is impossible: once tactical weapons are used, such a war would escalate into strategic war. According to the author the remedy must therefore be a substitution of smart nonnuclear defenses.

5400 **Moving to defenses through the defense-protected build-down (DPB).** Barkenbus, J.N. (Inst. for Energy Analysis, Oak Ridge Associated Universities (US)); Weinberg, A.M. vp of Strategic defenses and arms control. Weinberg, A.M.; Barkenbus, J.N Paragon House Pubs., New York, NY (1988).

The authors share the President's goal of moving away from security based upon offensive supremacy; yet share the critics' concerns over the approach the Reagan Administration has taken to getting us there. Their focus, therefore, is on defining and highlighting a transition from offensive to defensive dominance that provides some assurance of stability. The primary means or mechanism for accomplishing this task is something that, in previous articles, they have called the defense-protected build-down (DPB) - i.e., the simultaneous and commensurate build-up of missile defenses, with the build-down of offensive nuclear weapons. In this paper, the authors describe the primary advantages of the DPB process and speak in general terms of how it might be implemented. They discuss DPB with greater specificity, as it is portrayed in the context of a movement toward defense-dominance; and finally, they speculate as to possible Soviet responses to DPB.

5401 **Second thoughts on the defensive transition.** Weinberg, A.M. (Inst. for Energy Analysis, Oak Ridge Associated Univs. (US)); Barkenbus, J.N. vp of Strategic defenses and arms control. Weinberg, A.M.; Barkenbus, J.N Paragon House Pubs., New York, NY (1988).

In this paper, the authors review arguments, many of them very old, that support preference for a defense-dominated world. In making these arguments they restate the traditional arguments favoring the offensive world. Second, they summarize the principles that must govern a defense-protected build-down if the transition to defense-dominance is to be both arms-control- and crisis-stable. They catalogue specific policies and actions, which several authors have suggested, that in greater or lesser degree embody these principles, and that might be part of a real-world DPB.

3502 Proliferation

Refer also to citation(s) 5369

5402 (AD-A–211393/4/XAB) **Strategic defenses and crisis stability. Interim report.** Wilkening, D.; Watman, K.; Kennedy, M.; Darilek, R. RAND Corp., Santa Monica, CA (USA). Apr 1989. 57p. (RAND/N–2511-AF). Available from NTIS, PC A04/MF A01.

The effect that defenses have on crisis stability is one of the central issues in the current debate over the Strategic Defense Initiative (SDI). Crisis stability would be threatened in a situation in which either the United States or the Soviet Union feels pressure to strike first in the hope of producing a more favorable outcome to what appears to be inevitable nuclear war. This note examines various issues surrounding the question of crisis stability. In particular, it considers options for ameliorating any potential instabilities that might arise during a transition to higher levels of strategic defenses. The authors suggest that a crisis-stable transition is possible, that the mutual survivability of strategic offensive forces is crucial to maintaining crisis stability, that space-based defenses of strategic offensive forces (SOF) are potentially crisis-destabilizing unless they are backed up by terminal defenses of SOF, and that the mutual survivability of strategic defenses and defense suppression forces is also critical to crisis stability.

36 MATERIALS

5403 (LBL–26455) **Materials and Chemical Sciences Division annual report, 1988.** Lawrence Berkeley Lab., CA (USA). Jul 1989. 236p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. Order Number DE90003301. Available from NTIS, PC A11/MF A01 - OSTI; GPO Dep.

Research programs, from Lawrence Berkeley Laboratory, are briefly described. Research areas include: metallurgy and ceramics, solid-state physics, materials chemistry, fundamental interactions, processes and techniques, fossil energy, electrochemical energy storage, health and environmental science, and exploratory research. Individual projects are processed separately for the data bases. (CBS)

3601 Metals and Alloys

Refer also to citation(s) 4559, 4577, 4734, 4765, 4978, 5070, 5121, 5122, 5123, 5124, 5181, 5359, 5502, 5665, 5669, 5670, 5671, 5901, 6116, 6220, 6232, 6235, 6346, 6347, 6349, 6401, 6406, 6450, 6451

5404 (AD-A–211377/7/XAB) **Intermediate phases in some rare-earth-metal - iridium systems.** Blazina, Z.; Mohanty, R.C.; Raman, A. Southern Univ., Baton Rouge, LA (USA). 1989. 6p. Available from NTIS, PC A02/MF A01.

Pub. in Zeitschrift fuer Metallkunde, 192-196(1989).

Crystal structures of all the possible phases encountered in several Ln-Ir(Ln = La, Ce, Nd, Gd, Y and Er) systems were investigated using powder X-ray-diffraction technique and comparison with powder patterns of known phases in the Ln-Rh and Ln-Ru systems. Fe_3C Mn_5C_2 Pu_5Rh_3 and $MgCu_2$ type structures occur in most of these rare earth systems. The Th_7Fe_3-type structures occur only in the La and Ce systems with Ir. The $CaCu_5$-type structure occurs in the Ir systems with light rare earths from La to Nd, unlike its occurrence only in the heavy rare earth-Rh systems. Ir behaves like Ru in the rare earth-rich alloys, but it shows more similarity with Rh in alloys having > 30 at % Ir. Mean atomic volume considerations indicate Ir-atom contractions in the rare earth-rich alloy phases, whereas the rare earth atoms seem to contract a lot in the Ir-rich phases. Ir seems to have slightly larger atomic volume in these Ir-rich alloy phases.

5405 (AD-A–211406/4/XAB) **Investigation of the irradiation-swelling mechanisms in refractory metals at high temperatures. Final scientific report, 1 March 1985-31 July 1988.** Bajaj, R.; Hall, B.O.; Fenske, G.R.; Greggi, J.C.; Taylor, A.T. Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Energy Systems Div. Jun 1989. 267p. (WAES-TR–89-0010). Available from NTIS, PC A12/MF A01.

This report presents the results of an investigation of elevated-temperature irradiation swelling in refractory metals with an objective of understanding swelling mechanisms in these materials and demonstrating practicality of swelling-resistant materials. The study was divided into three phases. During the first phase, a theoretical model was developed for the swelling in body-centered cubic (bcc) metals. The model was based on chemical reaction rate formalism. Calculations were carried out on on a model material, niobium, which was selected for the study. Experimental and theoretical work was conducted to determine the swelling mechanism. Niobium was irradiated with Nb(++) ions to a dose of 50 dpa and swelling was determined by transmission electron microscopy. A peak swelling at 900C of 7% was observed. No swelling was observed above 1300C. The experimental data were compared to those predicted by the theoretical model. Reasonable agreements were obtained between the experimental and theoretical swelling curve when niobium-oxygen interaction was included. Sink-strength ratios were also calculated from the data. The theoretical model was extended during the second phase to include loop growth/shrinkage in bcc metals. During the third phase of the program, two alloys, Nb-5Hf and Nb-5W, were irradiated with Nb(++) alone and with Nb(++) + He(+) over a temperature range of 800 - 1350C. (AW)

5406 (CEA-N–2612) **Modelization of ratcheting in biaxial experiments.** Guionnet, C. CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques. Aug 1989. 62p. (In French). Order Number DE90727325. Available from NTIS (US Sales Only), PC A04/MF A01.

A new unified viscoplastic constitutive equation has been developed in order to interpret ratcheting experiments on mechanical structures of fast reactors. The model is based essentially on a generalized Armstrong Frederick equation for the kinematic variable; the coefficients of the dynamic recovery term in this equation is a function of both instantaneous and accumulated inelastic strain which is allowed to vary in an appropriate manner in order to reproduce the experimental ratcheting rate. The validity of the model is verified by comparing predictions with experimental results for austenitic stainless steel (17-12 SPH) tubular specimens subjected to cyclic torsional loading under constant tensile stress at 600^0C.

5407 (CEGB-RD/B–6044/R88) **Carbon deposition on nickel ferrites and nickel-magnetite surfaces.** Allen, G.C.; Jutson, J.A. Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs. Jun 1988. 26p. (CDMSG/P–(88)36). Order Number DE90609706. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Carbon deposition on Commercial Advanced Gas-Cooled Reactor (CAGR) fuel cladding and heat exchanger surfaces lowers heat transfer efficiency and increases fuel pin temperatures. Several types of deposit have been identified including both thin dense layers and also low density columnar deposits with filamentary or convoluted laminar structure. The low-density types are often associated with particles containing iron, nickel or manganese. To identify the role of nickel in the deposition process surfaces composed of nickel-iron spinels or metallic nickel/magnetite mixtures have been exposed to γ radiation in a gas environment simulating that in the reactor. Examination of these surfaces by Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM) have shown that while metallic nickel (Ni(O)) catalyses the formation of filamentary low density carbon deposits, the presence of divalent nickel (Ni(II)) sites in spinel type oxides is associated only with dense deposits. (author).

5408 (CEGB-RD/B–6062/R88) **Dependence of the oxidation behaviour of 20%Cr austenitic steels on their silicon content.** Lobb, R.C.; Sasse, J.A.; Evans, H.E. Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs. Oct 1988. 24p. Order Number DE90609707. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The role of silicon in the oxidation of a series of 20%Cr/25%Ni/Nb-stabilised steels containing silicon in the range 0 to 2.25 wt.%. has been explored. Oxidation tests have been performed in thermobalances at 1173K (900°C) in a CO_2-based gas at 1 atmosphere total pressure for exposure periods extending to 1.12×10^6s (310h). The oxidation kinetics were parabolic in all cases with a rate constant that achieved a minimum value in alloys containing ~ 0.6 wt.% silicon. This minimum was associated with the development of a thin silicon-rich interlayer (presumed to be silica) between the chromia and steel. It is suggested that the growth of the chromia layer was controlled by the diffusion of chromium ions through the thickening silica interlayer. At higher alloy silicon levels, the thicker silica interlayer tended to be fragmented and the overall oxidation resistance was reduced. By contrast, the extent of oxide spallation on cooling was least in the silicon-free and dilute alloys and increased progressively with increasing silicon levels. It is considered that although the intrinsic adherence of the chromia was increased by the presence of a silica interlayer, interfacial crack formation within this layer became favoured as the thickness of the silica increased. (author).

5409 (CEGB-RD/M–1731/RR88) **Welding of oxide coated steel using the MIG process.** Morgan-Warren, E.J. Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs. Jul 1988. 15p. Order Number DE90609642. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The penetration of an oxidised steel surface during metal inert gas (MIG) welding, for reactor repairs, is discussed. Using simple models, the effect of deoxidation practice on the penetrating capability of the welding process is estimated, and it is shown that the addition of aluminium to the welding wire can increase the fusion of the oxidised surface. Other modifications to the MIG welding process to influence penetration characteristics are discussed briefly, including shielding gas changes and cored wires. (author).

5410 (CEGB-RD/M–1736/RR88) **Reference stress approach for the characterisation of the creep failure of dissimilar welds under isothermal conditions.** Nicholson, R.D. (Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs.); Williams, J.A.; Soo, J.N.; Nath, B. Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs. Nov 1988. 24p. Order Number DE90609643. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In high temperature power plant, welds between austenitic and ferritic steels are required to operate under plant conditions for up to 250,000h. The experience and failure modes for such joints are briefly surveyed in this report. A semi-empirical reference stress approach is used to define the failure life of joints under isothermal conditions. The reference stress is based on a previously published form for multiaxial creep fracture of homogeneous materials but modified to include an additional factor to reflect the complex strains present close to the interface in a dissimilar weld. This reference stress can be modified to give approximate bounds characterised by the equivalent stress or the axial stress on the weld. The reference stress, when applied to the 21/4Cr1Mo:Type 316 welded component data base, gives conservative results for the test data available although conservatism is low for the 9Cr1Mo:Alloy 600 combination. The existing data base for welded components is limited. More data are needed covering a wider range of stress ratios and incorporating bending loads. (author).

5411 (CONF-891024–6) **Materials technology at Argonne National Laboratory.** Betten, P. Argonne National Lab., IL (USA). [1989]. 11p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From The Metallurgical Society fall meeting: materials week; Indianapolis, IN (USA); 1-5 Oct 1989. Order Number DE90003773. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Argonne is actively involved in the research and development of new materials research and development (R & D). Five new materials technologies have been identified for commercial potential and are presented in this paper as follows: (1) nanophase materials, (2) nuclear magnetic resonance (NMR) imaging of ceramics, (3) superconductivity developments and technology transfer mechanisms, and (4) COMMIX computer code modeling for metal castings, and (5) tribology using ion-assisted deposition (IAB). 4 refs., 7 figs., 1 tab.

5412 (CONF-891093–10) **Confirmation of an exception to the "general rule" of surface relaxations.** Noonan, J.R.; Davis, H.L. Oak Ridge National Lab., TN (USA). Oct 1989. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 36. American Vacuum Society national vacuum symposium; Boston, MA (USA); 23-27 Oct 1989. Order Number DE90002496. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

LEED I-V spectra for Al(111) have been remeasured and analyzed to resolve a conflict concerning interlayer relaxations that are induced by the creation of the surface. Previous measurements of the Al(111) surface relaxations generally report a small expansion of the first interplanar spacing with respect to the bulk spacing. Several recent theories not only predict a contraction, but also that an expansion is not even possible with the formalism used. A larger database of I-V measurements at room temperature and at 160K has been compared to a very extensive set of calculated spectra. It was determined that the surface was expanded, $\Delta d_{12} = +1.7 \pm 0.3\%$, $\Delta d_{23} = +0.5 \pm 0.7\%$. Importantly, the analysis has also identified surface enhanced thermal motions and no temperature dependence for the static interplanar relaxation within an accuracy of 0.007 Å. 37 refs., 8 figs.

5413 (CONF-891117–10) **Two-dimensional magnetic phase transition of ultrathin iron films on Pd(100).** Liu, C.; Bader, S.D. Argonne National Lab., IL (USA). [1989]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 34. conference on magnetism and magnetic materials; Boston, MA (USA); 28 Nov - 1 dec 1989. Order Number DE90003555. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Epitaxial Fe films grown on Pd(100) are used to study monolayer magnetism, critical behavior, and surface magnetic anisotropy, by means of in-situ surface magneto-optical Kerr-effect measurements. Auxilliary LEED-Auger observations in 10^{-11} Torr vacuum are used to characterize the (1 x 1) epitaxy and the layer-by-layer film-growth mode. Ferromagnetic hysteresis loops were detected for all Fe thickness from 0.6-4 monolayers (ML) with the T_c monotonically increasing with thickness, independent of the easy-axis orientation. The easy axis is perpendicular to the film plane below a critical thickness of 2.5 ML for 100-K film growth, and reorients in-plane above this thickness, and for all thicknesses for films grown at 300K. The temperature dependence of the magnetization was obtained from the height of the Kerr loops in the remanent state and used to extract an effective magnetization exponent β for different film thicknesses and spin orientations. A value of $\beta = 0.127 \pm 0.004$ is reported for a 1.2-ML Fe film with perpendicular spin orientation from a log-log plot for $T > 0.9T_c$, in agreement with the value of the theoretical 2-dimensional Ising critical exponent $\beta_c = 1/8 = 0.125$.

5414 (CONF-891119–16) **Irradition-induced grain growth: Role of dislocations.** Allen, C.W.; Rehn, L.E. Argonne National Lab., IL (USA). Nov 1989. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Materials Research Society fall meeting; Boston, MA (USA); 27 Nov - 2 dec 1989. Order Number DE90003565. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Existing theories of irradiation-induced grain growth assume that growth occurs by the boundary migration mechanism commonly observed for thermal growth and that is is only the point defects generated at boundaries during the irradiation which are responsible for boundary migration. In contrast, in situ observations during ion irradiation of Au films at temperatures less than 20 K even have clearly demonstrated that growth occurs both by boundary migration and by grain coalescence. Here we present further evidence for the latter. Furthermore, the substantial defect cluster activity observed during irradiation suggests that dislocations play a significant role in the growth phenomenon. Here, we also demonstrate qualitatively that glide of such dislocations to or "through" a boundary can produce essentially the same effect on boundary position or structure that the original point defects would have had if they had migrated individually to or through the boundary. Via dislocation motion, point defects originating far from a boundary may induce boundary migration or boundary structure change, and hence, grain growth. 11 refs., 3 figs.

5415 (CONF-891119–26) **Molecular-dynamics study of the amorphization of CuTi.** Sabochick, M.J. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). Dept. of Engineering Physics); Lam, N.Q. Argonne National Lab., IL (USA). Nov 1989. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Materials Research Society fall meeting; Boston, MA (USA); 27 Nov - 2 dec 1989. Order Number DE90003563. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Radiation-induced amorphization of the crystalline compound CuTi was investigated by molecular-dynamics simulations using new interatomic potentials derived from the embedded-atom method. Two different approaches to amorphization were tried: one in which Cu and Ti atoms were randomly exchanged, and another in which Frenkel pairs were introduced at random. The potential energy, volume expansion and pair-correlation function were calculated as functions of chemical disorder and atomic displacements. The results indicate that, although both chemical disordering and point-defect introduction increase the system energy and volume, the presence of Frenkel pairs is essential to trigger the crystalline-to-amorphous transition. 20 refs., 3 figs.

5416 (CONF-891119–31) **Neutron irradiated uranium silicides studied by neutron diffraction and Rietveld analysis.** Birtcher, R.C. (Argonne National Lab., IL (USA)); Mueller, M.H.; Richardson, J.W. Jr.; Faber, J. Jr. Argonne National Lab., IL (USA). Nov 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Materials Research Society fall meeting; Boston, MA (USA); 27 Nov - 2 dec 1989. Order Number DE90003787. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Uranium silicides have been considered for use as reactor fuels in both high power and low enrichment applications. However, U_3Si was found to become amorphous under irradiation and to become mechanically unstable to rapid growth by plastic flow. U_2Si_2 appears to be stable against amorphization at low displacement rates,

but the extent of this stability is uncertain. Although the mechanisms responsible for plastic flow in U_3Si and other amorphous systems are unknown, as is the importance of crystal structure for amorphization, it may not be surprising that these materials amorphize, in light of the fact that many radioactive nuclide - containing minerals are known to metaminctize (lose crystallinity) under irradiation. The present experiment follows the detailed changes in the crystal structures of U_3Si and U_3Si_2introduced by neutron bombardment and subsequent uranium fission at room temperature. U-Si seems the ideal system for a neutron diffraction investigation since the crystallographic and amorphous forms can be studied simultaneously by combining conventional Rietveld refinement of the crystallographic phases with Fourier-filtering of the non-crystalline scattering component.

5417 (CONF-8904290–4) **High resolution electron microscopy of grain boundaries in nanophase palladium.** Thomas, G.J. (Sandia National Labs., Albuquerque, NM (USA)); Siegel, R.W.; Eastman, J.A. Argonne National Lab., IL (USA). Sep 1989. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Symposium J: interfaces between polymers, metals and ceramics; San Diego, CA (USA); 24-29 Apr 1989. Order Number DE90003823. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Using high resolution electron microscopy, considered nanophase palladium samples were examined following electrolytic thinning after a hydriding-dehydriding cycle at 310 K. Due to the small size and random orientations of the individual grains, a large number of grain boundaries were available for examination. Some of these yielded adequate imaging conditions to allow observation of the lattice structure in the grain boundary regions. Image simulations were performed to determine the sensitivity of the technique to lattice disorder. The results of these studies suggest that grain boundary structures in nanophase palladium are similar to those in conventional coarse-grained polycrystals. 12 refs., 2 figs.

5418 (CONF-8909207–3) **Dislocation climb mechanisms in electron irradiated Fe-Ni-Cr alloys.** King, S.L. (Oxford Univ. (UK). Dept. of Metallurgy and Science of Materials); Jenkins, M.L.; Kirk, M.A.; English, C.A. Argonne National Lab., IL (USA). Sep 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From EMAG-MICRO 89 meeting; London (UK); 13-15 Sep 1989. Order Number DE90003804. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper presents preliminary results of a study of the interaction of point defects produced by HVEM irradiation with pre-existing dissociated dislocations in a range of Fe-Ni-Cr alloys, aimed at determining their climb mechanism(s). 5 refs., 4 figs.

5419 (CONF-8909267–1) **Formation of Zintl-ions in alkali-lead alloys.** Reijers, H.T.J. (Rijksuniversiteit Groningen (Netherlands). Solid State Physics Lab.); van der Lugt, W.; Saboungi, M.-L.; Price, D.L. Argonne National Lab., IL (USA). [1989]. 5p. Sponsored by U.S. DOE Energy Research; Netherlands Organization for the Advancement of Pure Research (Nederlandse Organisatie voor Zuiver W. DOE Contract W-31109-ENG-38. From 7. international conference on liquid and amorphous metals; Kyoto (Japan); 4-8 Sep 1989. Order Number DE90001436. Available from NTIS, PC A02/MF A01 - OSTI.

In the last years the liquid alkali-Pb alloys have been studied extensively. The measurements made include resistivity, structure factor, and the specific heat capacity. These alloys show anomalous behavior at either the octet composition with 80 at. % alkalimetal or at the equiatomic composition. From the resistivity measurements follows that a shift in stoichiometry occurs between Na-Pb and K-Pb. Whereas liquid Na-Ph, just as Li-Ph forms an octet compound, the K-Pb, Rb-Pb and Cs-Pb systems form only an equiatomic compound. In this paper we present the results of neutron diffraction and specific heat measurements. Together they constitute evidence for the formation of $(Pb_4)^{4-}$-ions in liquid K-Pb, Rb-Pb and Cs-Pb.

5420 (CONF-8909267–2) **Dynamical structure of liquid and amorphous metals.** Price, D.L. Argonne National Lab., IL (USA). Aug 1989. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 7. international conference on liquid and amorphous metals; Kyoto (Japan); 4-8 Sep 1989. Order Number DE90003805. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Our current understanding of the dynamics of disordered metals is reviewed, including collective excitations, single-particle motions and diffusive modes. Examples are given for liquid metals, metallic glasses and quasicrystals. 6 refs., 7 figs.

5421 (CONF-8911124–1-Vugraphs) **Atomic defects in the structural layers of hexagonal Er_2Fe_{17}.** Kumar, R.; Specht, E.D.; Sparks, C.J. Oak Ridge National Lab., TN (USA). 1989. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From User group science seminar; Los Alamos, NM (USA); 16-17 Nov 1989. Order Number DE90003040. Available from NTIS, PC A02/MF A01; OSTI; INIS.

X-ray and neutron powder diffraction has been carried out on the compound Er_2Fe_{17} which crystallizes in the Th_2Ni_{17} type ($P6_3/mmc$) hexagonal phase. $H - 2K = 3n$ $L = 2n$ are the strongest reflection in both x-ray and neutron powder diffraction pattern (for example 302) showing the ordered transition metal substitutions on the planes perpendicular to c axis resulting in ABABAB···sequence of basic structural layers. However, $H - K \neq 3n$ $L = 2n$ type reflections have been observed with sizable intensities in the neutron diffraction spectrum. The very appearance of these reflections indicates that there is less than complete order on A and B chains, and some random substitutions take place on C chains, resulting in Fe-rich side of the 2:17 stoichiometry. These defects in the stacking sequences of hexagonal layers linked with the fine scale metallurgical microstructure have profound influence on the magnetic properties required in the design of new hard magnetic materials. 7 figs.

5422 (DOE/ER/13663–T3) **Structure and reactivity of chemisorbed species and reaction intermediates: Final report, December 1, 1981–December 4, 1989.** Madey, T.E. National Inst. of Standards and Technology, Gaithersburg, MD (USA). Surface Science Div. 1 Aug 1989. 25p. Sponsored by U.S. DOE Energy Research. DOE Contract AI01-87ER13663. Order Number DE90003244. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report covers a broad 8-year experimental program relating to the structure and reactivity of chemisorbed species and reaction intermediates in surface reactions and catalysis by metals, semiconductors and oxides. Ultrahigh vacuum methods have been used throughout, and the program was divided loosely into two activities: (1) structure and reactivity of chemisorbed species and (2) surface reactions and catalysis over well-characterized surfaces. 81 refs., 2 figs.

5423 (DOE/ER/45055–24) **An investigation of mechanical behavior of crystalline solids: Final report for the period of March 1984–June 1988.** Li, C.Y. Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science. [1988]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-84ER45055. Order Number DE90003530. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Brief summaries of twenty-four research programs on the mechanical behavior of crystalline solids are presented. Materials studied include Incoloys, copper, stainless steel 316, and aluminum-magnesium alloys. (CBS)

5424 (DOE/ER/45294–3) **Brittle to ductile transition in cleavage fracture: [Year-end progress report].** Argon, A.S. Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Mechanical Engineering. [1989]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER45294. Order Number DE90003532. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The understanding of brittle to ductile transition of fracture in solids continues to be an important goal both from the point of view of fundamental considerations of the physics of fracture and from the viewpoint of operational practice. Recently much progress was made on the former front through the study of the temperature dependence of the conditions of cleavage fracture initiation in single crystal Si[1-5]. The approach taken in this study has been that this basic transition in fracture can be best understood with greater insight and precision by studying the conditions of arrest of propagating cleavage cracks in nearly perfect single crystals. For the above reasons the research carried out since the spring of 1987 on

the present DOE supported program has been pursuing two parallel and complementary directions. The main thrust of the program has been experimental in which cleavage cracks in single crystalline material are propagated at nearly constant velocity in a specimen with a steep temperature gradient to determine the temperature of cleavage crack arrest from a measurable velocity. In the subsidiary thrust, modeling is being performed of the dislocation emission process from crack tips. The progress in these two related directions is discussed below, followed by a proposal for incremental additional funding to achieve the initially designated goals.

5425 (DP-MS–89-27) **Microstructure and yield strength effects on hydrogen and tritium induced cracking in HERF [high-energy-rate-forged] stainless steel.** Morgan, M.J.; Tosten, M.H. Westinghouse Savannah River Co., Aiken, SC (USA). [1989]. 38p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. (CONF-8909204–5: Conference on hydrogen effects on material behavior, Jackson Hole, WY (USA), 12-16 Sep 1989). Order Number DE90003505. Available from NTIS, PC A03/MF A01 - OSTI.

Rising-load J-integral measurements and falling-load threshold stress intensity measurements were used to characterize hydrogen and tritium induced cracking in high-energy-rate-forged (HERF) 21-6-9 stainless steel. Samples having yield strengths in the range 517–930 MPa were thermally charged with either hydrogen or tritium and tested at room temperature in either air or high-pressure hydrogen gas. In general, the hydrogen isotopes reduced the fracture toughness by affecting the fracture process. Static recrystallization in the HERF microstructures affected the material's fracture toughness and its relative susceptibility to hydrogen and tritium induced fracture. In hydrogen-exposed samples, the reduction in fracture toughness was primarily dependent on the susceptibility of the microstructure to intergranular fracture and only secondarily affected by strength in the range of 660 to 930 MPa. Transmission-electron microscopy observations revealed that the microstructures least susceptible to hydrogen-induced intergranular cracking contained patches of fully recrystallized grains. These grains are surrounded by highly deformed regions containing a high number density of dislocations. The microstructure can best be characterized as "duplex", with soft recrystallized grains embedded in a hard, deformed matrix. The microstructures most susceptible to hydrogen-induced intergranular fracture showed no well-developed recrystallized grains. The patches of recrystallized grains seemed to act as crack barriers to hydrogen-induced intergranular fracture. In tritium-exposed-and-aged samples, the amount of static recrystallization also affected the fracture toughness properties but to a lesser degree. 7 refs., 25 figs.

5426 (DPST–61-183) **The solubility of lithium in aluminum.** Marshall, R.P.; Costas, L.P. Savannah River Lab., Aiken, SC (USA). 28 Feb 1961. 19p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. Order Number DE90003915. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In conjunction with other work on the aluminum-lithium alloy system at SRL, the solubility of lithium in alpha aluminum as a function of temperature was investigated by the measurement of electrical resistivity of a series of alloys and by hardness measurements along a diffusion gradient. In addition to a revised curve for the aluminum-rich end of the aluminum-lithium constitution diagram, the attached report contains a summary of the experimental techniques, which will be of interest to others who are involved with the aluminum-lithium alloy system.

5427 (GKSS–89/E/17) **Formation of titanium aluminides by heat treatment of extruded elemental powders.** Dahms, M. (GKSS-Forschungszentrum Geesthacht GmbH, Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Werkstofforschung). GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). 1989. 6p. Available from Special print from Mater. Sci. Eng., A (Mar 1989) v. 110(1/2) p. L5-L8.

A procedure is presented for the formation of titanium aluminides from elemental powders. This procedure consists of mainly two parts. Blended elemental powders are cold extruded in order to produce fully dense rods. The rods are then annealed in order to obtain titanium aluminides. It is shown that additional deformation leads to a decreasing porosity in the annealed material. (orig.).

5428 (IFVE-OUNK–87-173) **Magnetic characteristics of St3 steel at 4.2-300 K.** Prijma, M.V.; Shirshov, L.S.; Shcherbakov, P.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1987. 8p. (In Russian). Order Number DE90610761. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Measurement results of the static magnetic charactristics ofthe toroidal samples of the constructional steel under cooling up to 4.2 K are presented. Magnetic characteristics variation for the sample made from sheets of different meltings is shown. Hysteresis losses in the symmetric and particular cycles of magnetization have been measured. 4 refs.; 5 figs.

5429 (IM–2243) **Microstructure and mechanical properties of TiN precipitation hardened 316L stainless steel produced by hot extrusion of rapidly solidified powder.** Li Yuezhu; Arnberg, L. Swedish Inst. for Metals Research, Stockholm (Sweden). Oct 1987. 30p. Order Number DE90610758. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A precipitation hardened Ti-modified 316L stainless steel has been prepared by extrusion of nitrided rapidly solidified powder. The microstructure and mechanical properties of rapidly solidified powder, internally nitrided powder and extruded bulk material have been investigated. It has been found that the microstructure of extrudates consists of fine austenite grains and uniformly dispersed titanium nitride particles, as well as subgrains with dislocation tangles. Finely disperesed nitride particles suppress the grain growth by pinning the grain boundaries during recrystallization. A signigicant improvement of tensile properties, hardness and creep properties is obtained, as compared to conventional 316L stainless steels. (authors).

5430 (IM–2258) **High-temperature tensile properties of rapidly solidified TiN precipitation hardened 316L stainless steel.** Li Yuezhu; Arnberg, L. Swedish Inst. for Metals Research, Stockholm (Sweden). Aug 1987. 22p. Order Number DE90610759. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A 316L stainless steel has been TiN precipitation hardened by atomization of the Ti-modefied alloy, solid state nitridation of the powder and subsequent hot extrusion of the powder. Two alloys, one with 0.70 wt%Ti and 0.24 wt% N and the other with 0.87 wt% Ti and 0.22 wt% N have been prepared. Both steels show TiN particles finely dispersed in the matrix, but the alloy with the higher Ti concentration shows a less uniform microstructure with a coarser TiN-distrubution. Tensile testing of the alloys has been performed from room temperature to 700 degree C. In this temperature range both the TiN-hardened alloys show a significant increase in strength as compared to conventional 316L stainless steel. It has been observed that the structural and chemical inhomogeneities of the alloy with 0.87 wt% Ti decreases its strength. (authors).

5431 (INIS-BR–1752, pp. 204-207) **Measures of hyperfine interaction in $V_{2(1-x)}M_{2x}O_3$.** Saitovitch, H. (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, RJ (Brazil)); Silva, P.R.J. Secretaria Estadual de Ciencia e Tecnologia, Rio de Janeiro, RJ (Brazil). 1989. (In Portuguese). (CONF-8908187–: 2. state meeting of new materials and 1. Florida-Brazil seminar on materials, Rio de Janeiro (Brazil), 2-4 Aug 1989). In *Advanced Ceramics.* Order Number DE90608004. Available from NTIS (US Sales Only), PC A16/MF A01 - OSTI; INIS.

An investigation about the metal-insulating transition in vanadium sesquioxide, V_2O_3 with chromium and titanium impurities is presented. The measure technique is the differential angular correlation and the isotope probe is the Cd . The electric field gradient in the various phases and temperatures is also calculated. (C.G.C.).

5432 (INIS-SU–129, pp. 272-273) **Preparation of indium antimonide epitaxial layers with enhanced electrical properties.** Arbenina, V.V. (Moskovskij Inst. Tonkoj Khimicheskoj Tekhnologii, Moscow (USSR)); Akchurin, R.Kh.; Zhegalin, V.A.; Kovaleva, V.N.; Potapov, S.N. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 1 tab. ANTIMONY ALLOYS/carrier density; ANTIMONY ALLOYS/epitaxy; INDIUM ALLOYS/carrier density; INDIUM ALLOYS/epitaxy; ANNEALING; EPITAXY; CARRIER MOBILITY; CRYSTALLIZATION; IMPURITIES; INTERMETALLIC COMPOUNDS; RARE EARTH ADDITIONS

5433 (INIS-SU–135/A) **Welding in nuclear technology. Scientific-technical collection.** Voprosy atomnoj nauki i tekniki. v. 2(21). Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. 42p. Order Number DE90705985. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Individual papers are processed separately for the data base. (DLC)

5434 (INIS-SU–135/A, pp. 3-11) **Development and production of equipment complex for welding and other type of working of plastic pipelines.** Kurkumeli, A.A.; Doronin, V.A.; Petrov, B.N. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Welding in nuclear technology. Scientific-technical collection.* Order Number DE90705985. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Voprosy atomnoj nauki i tekhniki.; v. 2(21).

Results of work on realizing program of welding and working of plastic tubes are presented. The program provides for development of welding equipment and standard-technical documentation for items, produced by welding of plasttic tubes 16-630 mm in diameter. The information, presented in the paper, is of particular interest for desing and mounting organizations, concerned with designing, production and mounting of process pipelines. It also promotes the formation of favourable situration in organizing demand for welding equipment as commodity-marketing requirement. 6 refs.; 5 figs.; 2 tabs.

5435 (INIS-SU–135/A, pp. 11-15) **Mounting welding devices.** Suvorov, V.P. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Welding in nuclear technology. Scientific-technical collection.* Order Number DE90705985. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Voprosy atomnoj nauki i tekhniki.; v. 2(21).

Problems of designing device for plastic tube welding during mounting are considered. Machine design and their operation are described. Specifications and adjustment diagrams for welding of various articles are given. 4 refs.; 2 tabs.

5436 (INIS-SU–135/A, pp. 16-20) **Design requirements under development of equipment complex for plastic tubes welding.** Fablov, V.S. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Welding in nuclear technology. Scientific-technical collection.* Order Number DE90705985. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Voprosy atomnoj nauki i tekhniki.; v. 2(21).

Principles of formation of equipment complex for plastic tube working are determined and its properties are described. A seris of similar mounting portable (transportable) equipment and the main forming units of shop stationary equipment are taken as examples. Ways of improving developments on the basis of suggested principles have been assigned. 4 refs.; 5 figs.

5437 (INIS-SU–135/A, pp. 21-24) **Welding procedure of pipes of thermoplastic.** Khankin, Yu.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Welding in nuclear technology. Scientific-technical collection.* Order Number DE90705985. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Voprosy atomnoj nauki i tekhniki.; v. 2(21).

Consideration is given to the sequence and peculiarities of production operations of butt hot-tope welding of polyethylene and polypropylene tubes. Methods of destructive testing of weld are correlated. Data on the developed standard-process documentation are presented. 12 refs.; 1 fig.; 1 tab.

5438 (INIS-SU–135/A, pp. 24-26) **Antiadhesive coatings of welding devices heating surface.** Shigorina, I.I.; Timofeeva, L.P. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Welding in nuclear technology. Scientific-technical collection.* Order Number DE90705985. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Voprosy atomnoj nauki i tekhniki.; v. 2(21).

Consideration is given to drawbacks of one of the main units of welding equipment-heater without coating, antiadhesive to melting of polyolifin tubes. Important problem of improving technical characteristics of the heater was solved successfully in result of creating a new heat.-resistant fluorolon coating FAP-34, antiadhesive to melt of polyolefin tubes. Operating properties of the coating are given. High efficiency of using coating on heaters for plastic tube welding is shown. 1 tab.

5439 (INIS-SU–135/A, pp. 26-31) **Equipment for welding of details and joints of plastic pipes in work shop conditions and at pipelines.** Doronin, V.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Welding in nuclear technology. Scientific-technical collection.* Order Number DE90705985. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Voprosy atomnoj nauki i tekhniki.; v. 2(21).

A range of welding machines for operation in workshop conditions and at pipelines is presented. Set of welding equipment for mobile shop, producing prototypes, and mobile facility are developed. In 1989 they will provide the whole operation cycle of production and mounting of details and units of plastic tubes and will enable to organize the centralized production of welded and shaped details in the branch, thus excluding the shortage of these details. 8 refs.; 6 figs.; 2 tabs.

5440 (INIS-SU–135/A, pp. 31-36) **Guarantee of reliability of devices complexes for plastic tube welding.** Voskresenskij, L.A.; Zajtsev, A.I.; Nelyubov, V.I.; Fedorov, M.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Welding in nuclear technology. Scientific-technical collection.* Order Number DE90705985. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Voprosy atomnoj nauki i tekhniki.; v. 2(21).

Results of calculations and experimental studies on providing reliability of complex for plastic tube welding are presented. Choice of reliability indeces and standards is based. Reliability levels of components are determined. The most waded details are calculated. It is shown that they meet the reqrurements of strength and reliability. Service life tests supported the correct choice of springs. Recommendations on elevating reliability are given. Directions of further developments are shown. 8 refs.; 2 figs.; 1 tab.

5441 (INIS-SU–135/A, pp. 36-40) **System of heaters temperature regulation for butt and bell welding of plastic tabes.** Yudovich, Yu.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Welding in nuclear technology. Scientific-technical collection.* Order Number DE90705985. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Voprosy atomnoj nauki i tekhniki.; v. 2(21).

Results of development and testing of the system of temperature requlation for new types of heaters for plastic tube welding are presented. Specifications of heaters, temperature regulator, materials when producing units and devices of the system, as well as the data of fault testing are given. 5 refs.; 3 tabs.

5442 (INIS-SU–135/A, pp. 40-41) **Equipment and production technology for sanitary assembles of plastics.** Terekhin, V.I.; Boronin, V.D.; Vasil'ev, A.A. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike. 1988. (In Russian). In *Welding in nuclear technology. Scientific-technical collection.* Order Number DE90705985. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Voprosy atomnoj nauki i tekhniki.; v. 2(21).

Main directions of work on introduction plastic pipelines into the canalization systems of buildings are presented. They include fraining of specialists, the presence of suitable equipment, technological process and design solutions. Menfioned directions and revision of all house projects for conditions and requirements of changing traditional (cast iron) pipelines of plumbing systems for plastic ones enable to solve the problem of plastic pipeline introduction to canalization equipment and provide their reliable maintenance. 2 refs.

5443 (KFK–4594) **24 h-corrosion tests combined with electrochemical potential measurements of CrNi-steel DIN W.Nr. 1.4306 (AISI Type 304 L) in 7 molar nitric acid containing oxidizing metal ions at 90deg C.** Schanz, G.; Leistikow, S. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung. Jul 1989. 45p. (In German). Order Number DE90728839. Available from NTIS (US Sales Only), PC A03/MF A01.

Corrosion experiments - combined with measurements of the free corrosion potential of the steels under test and the redox potential of the corrosive nitric acid media - have been performed. Three different versions of the austenitic CrNi steel DIN W.Nr. 1.4306 (AISI Type 304 L) in the solution annealed condition were tested at 90deg C during 24 h in nitric acid and nitric acid solutions containing single or combined additions of Fe(III)-, Cr(VI)- and Ce(IV)-ions. The relationship between the rate of metal loss and the free corrosion potential of the corroding steels was confirmed to be an exponential one. Furthermore, it was shown that these short-term tests could reveal within a narrow band of free corrosion potentials (1150-1250 mV) an extent of surface corrosion which is specific for small compositional or microstructural differences of these steels. (orig.).

5444 (KFK–4620) **Chemical properties of the liquid blanket material Pb-17Li.** Borgstedt, H.U. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung. Aug 1989. 28p. (In German). Order Number DE90729149. Available from NTIS (US Sales Only), PC A03/MF A01.

The chemical properties of the alloy Pb-17Li are reviewed on the basis of literature data as they are of concern for the compabitility with materials. Main subject is the solubility of non-metallic substances such as hydrogen, oxygen, nitrogen, carbon, silicon, germanium, halides and noble gases, and of metals of technical importance as iron, chromium, nickel, manganese, beryllium, molybdenum and vanadium. The properties of the liquid alloy are mainly governed by the properties of the main component, lead. The chemical activity of lithium in the alloy is extremely low. (orig.).

5445 (LAFI–139) **Order parameter relaxation at phase transitions for radiation exposed metals.** Makletsov, A.A. AN Latvijskoj SSR, Riga (USSR). Inst. Fiziki. 1988. 24p. (In Russian). Order Number DE90609722. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Relaxation of the order parameter field at nonequilibrium first-order phase transition is studied for irradiated media. The former has been found to be due to cascade-producing radiation. Fluctuation correlations have been calculated for point defect concentrations and for an effective defect-production rate as well. Solution of the equation, determining the most probable way of the order-parameter-field relaxation, have been derived. Fluctuations have been shown to alter the crystal nucleus critical radius and the distribution of the order-parameter field in the supercritical nucleus. A loss of global stability has been found for the system with strong fluctuations. Cascade fluctuations have been shown to considerably affect stable defect aggregations in irraiated metals. 25 refs.; 7 figs.

5446 (LA-UR–89-3721) **Dynamical simulation of dislocation microstructure.** Gulluglo, A. (Michigan Univ., Ann Arbor, MI (USA). Dept. of Materials Science and Engineering); Srolovitz, D.J.; LeSar, R.; Lomdahl, P.S. Los Alamos National Lab., NM (USA). [1989]. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-8910304–1: TMS meeting on simulation and theory of evolving microstructures, Indianapolis, IN (USA), Oct 1989). Order Number DE90003192. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We report the development of a computer simulation technique to model the motion of a large number of mutually interacting dislocations under the influence of an applied stress. The dislocation motion is simulated using a method akin to molecular dynamics except that dislocation coordinates are employed instead of atomic coordinates. The formation of dislocation substructure is studied as a function of applied stress and density and the resulting spatial distribution of dislocations is analyzed. 5 refs., 3 figs.

5447 (LA-UR–89-4008) **Silicon-based coatings on niobium metal.** Stupik, P.D. (Harvard Univ., Cambridge, MA (USA). Dept. of Chemistry); Jervis, T.R.; Nastasi, M.; Donovan, M.M.; Barron, A.R. Los Alamos National Lab., NM (USA). [1989]. 7p. Sponsored by U.S. Department of Defense; National Science Foundation. DOE Contract W-7405-ENG-36. GC-A-969628;DMR-86-14003. (CONF-891119–12: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989). Order Number DE90003651. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Silicon coatings on niobium substrates were subjected to thermal, ion beam and laser mixing, and the effectiveness of the different methods for the synthesis of graded interfaces was compared. The resulting metal/silicon interfaces were characterized by x-ray photoelectron spectroscopy (XPS), auger electron spectroscopy (AES) and the Rutherford backscattering (RBS). 6 refs., 4 figs.

5448 (LBL–27774) **Isothermal fatigue behavior of Sn–Pb solder joints.** Summers, T.S.E.; Morris, J.W. Jr. Lawrence Berkeley Lab., CA (USA). Sep 1989. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-891208–25: Winter annual meeting of the American Society of Mechanical Engineers, San Francisco, CA (USA), 10-15 Dec 1989). Order Number DE90003280. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Isothermal fatigue data were collected for the compositions 5Sn–95Pb, 20Sn–80Pb, 40Sn–60Pb, 50Sn–50Pb and 63Sn–37Pb within the binary Sn–Pb system. All of these compositions are commercially available and include those most commonly used. Because Sn-rich solders are rarely used, they were not investigated here. The fatigue life was defined by a 30% load drop. The solders were tested in a double shear configuration joined to copper at 75°C. The displacement rate chosen was 0.01 mm/min, which corresponds to a strain rate of 1.5×10^{-4} s^{-1} for our specimen configuration, over a 10% plastic strain range. Additionally, the microstructural changes during fatigue are presented. The various solder compositions studied exhibit strikingly different as-solidified microstructures. These differences are discussed in terms of their effect on the isothermal joint failure mechanism and joint isothermal fatigue life. 24 refs., 10 figs.

5449 (N–89-27818) **Rapidly solidified titanium alloys by melt overflow.** Gaspar, T.A.; Bruce, T.J. Jr.; Hackman, L.E.; Brasmer, S.E.; Dantzig, J.A.; Baeslack, W.A. III. Ribbon Technology Corp., Gahanna, OH (USA); Ribbon Technology Corp., Gahanna, OH (USA). Sep 1989. 96p. (NASA-CR–4253;NAS–1.26:4253). Available from NTIS, PC A05/MF A01.

A pilot plant scale furnace was designed and constructed for casting titanium alloy strips. The furnace combines plasma arc skull melting techniques with melt overflow rapid solidification technology. A mathematical model of the melting and casting process was developed. The furnace cast strip of a suitable length and width for

use with honeycomb structures. Titanium alloys Ti-6Al-4V and Ti-14Al-21 Nb were successfully cast into strips. The strips were evaluated by optical metallography, microhardness measurements, chemical analysis, and cold rolling.

5450 (NRC/ACP–89-03549, pp. 21) **Development and application of diffusion braze repair techniques.** Stoykewich, S.G.; Armstrong, R.J. National Research Council of Canada, Ottawa, ON (Canada). Associate Committee on Propulsion. Sep 1987. (CONF-8709481–: 7. National Research Council of Canada (NRCC) symposium on industrial application of gas turbines, Banff (Canada), 27-30 Sep 1987; MICROLOG–89-03549). In *Proceedings [of the] seventh NRCC [National Research Council of Canada] symposium on industrial application of gas turbines.* Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

In the development of turbomachinery that operates at higher efficiencies (lower specific fuel consumption), engines are required to operate at increasingly higher temperatures. This has led to the use of new gamma prime strengthened nickel base superalloys to replace the cobalt base alloys previously used. Additionally, the new series of turbine nozzle guide vanes are cast with hollow cores, with subsequent machining or drilling to allow core cooling air to escape and form protective boundary layers. These changes have provided improved operating efficiencies but have led to difficulties in successful repairs; improved brazing alloys and techniques are therefore necessary. In this regard, repairing of turbine engine nozzle guide vanes with diffusion braze alloys is a viable alternative to conventional repair techniques. Tests show that the braze joint strength obtained with nickel base diffusion braze alloys on cobalt base (X-40) superalloys specimens was exceptional. Additionally, the joints display a greater degree of ductility relative to conventional nickel base non-diffusion braze alloy joints. When blended with base material alloy powder, the diffusion braze alloys are capable of brazing substantially large voids. The ability to apply a diffused aluminum-chromium coating on diffusion braze alloy repaired components was demonstrated. These capabilities will allow a repair agent to recover a greater percentage of turbine components. Similar results are predicted during repair of gamma prime strengthened nickel base superalloys. Unique to these alloys is the proposed method of cleaning: activated fluoride oxide reduction. 10 refs., 17 figs., 1 tab.

5451 (NRCC/IMR–29708) **Automation of pipe welding using machine vision and adaptive control.** Nadeau, F. (Tecnar Automation Ltd.); Blain, J.; Dufour, M. National Research Council of Canada, Boucherville, PQ (Canada). Industrial Materials Research Inst. 1989. 20p. (MICROLOG–89-03253). Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A method to measure and control in real time the penetration of the root pass in butt joints has been developed. The technology was applied to the development of a fully automated pipe-on-positioner welding system that performs both root and filler passes for joining ordinary carbon steel pipes and fittings. Using the gas metal-arc process, the whole operation on a 6 inch pipe takes less than 5 minutes compared to more than half an hour for manual shielded metal-arc welding. The machine uses artifical vision and adaptive feedback to actually control the penetration during the root pass ensuring a defect-free weld. 3 refs., 7 figs.

5452 (ORNL/FTR–3456) **[Diffuse x-ray data on Ni-Cr solid solutions]: Foreign trip report, September 30, 1989–October 21, 1989.** Sparks, C.J. Oak Ridge National Lab., TN (USA). 6 Nov 1989. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002658. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Attendance at the Second European Conference on "Progress in X-Ray Synchrotron Radiation Research" in Rome, Italy, October 2–6, 1989, provided new insight to and will enhance our progress toward implementing an x-ray microprobe with undulator radiation from the Argonne Advanced Photon Source. Wider application in Europe of tunable x rays to highlight specific sites for elements in various atom arrangements gave impetus to our own program on elemental substitution for alloy modification. 6 refs.

5453 (PB–89-873475/XAB) **Corrosion-resistant coatings. January 1974-March 1988 (Citations from the International Aerospace Abstracts data base). Report for January 1974-March 1988.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 162p. Available from NTISPC N01/MF N01.

See also PB–89-873483; U.S. sales only.

This bibliography contains citations concerning techniques and applications of such coatings as aluminum, chromium, nickel, ceramics, and plastics for such metals as steel, nickel, titanium, and cobalt. Performance of specific coatings under a range of conditions is considered. Coating processes and applications in the aerospace industry are included. (This updated bibliography contains 349 citations, none of which are new entries to the previous edition.)

5454 (PB–89-873483/XAB) **Corrosion-resistant coatings. April 1988-September 1989 (Citations from the International Aerospace Abstracts data base). Report for April 1988-September 1989.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 42p. Available from NTISPC N01/MF N01.

Supersedes PB–88-860499. See also PB–89-873475; U.S. sales only.

This bibliography contains citations concerning techniques and applications of such coatings as aluminum, chromium, nickel, ceramics, and plastics for such metals as steel, nickel, titanium, and cobalt. Performance of specific coatings under a range of conditions is considered. Coating processes and applications in the aerospace industry are included. (This updated bibliography contains 72 citations, all of which are new entries to the previous edition.)

5455 (PNL-SA–17432) **Instrumented tooling for optimization of cold drawing parameters in zircaloy tube fabrication.** Page, R.E. Pacific Northwest Lab., Richland, WA (USA). Sep 1989. 19p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-8911101–2: ASM conference on methods for reducing scrap in producing tubes, bars and shapes, Clearwater, FL (USA), 6-7 Nov 1989). Order Number DE90002729. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Under the Department of Energy/Westinghouse Hanford Company-sponsored Pressure Tube Cold Work Simulation Project, Pacific Northwest Laboratory (PNL) provided the pressure tube development engineering and metalworking to develop process parameters for draw sizing Zircaloy pressure tube extrusions using reduced-sized, extruded Zircaloy surrogate tubes. The extruded surrogate tube was sized to be drawable on our 50,000-pound drawbench while simulating actual pressure tube processing characteristic (strain ratio and cold working) that would develop the desired crystalline structure in the tube wall. Our objectives were (1) to assist our customers in initial selection of draw tooling and lubrications; and (2) to identify and solve tube drawing problems before the customer installed a 250,000-pound drawbench and began full-sized pressure tube drawing development. 2 refs., 7 figs.

5456 (SAND–89-1764C) **Heat treatment of pulsed Nd: YAG laser welds in a Ti-14.8 wt % Al-21.3 wt % Nb titanium aluminide.** Baeslack, W.A. III (Ohio State Univ., Columbus, OH (USA). Dept. of Welding Engineering); Cieslak, M.J.; Headley, T.J. Sandia National Labs., Albuquerque, NM (USA). [1989]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8905118–13: 2. international conference on trends in welding research, Gatlinburg, TN (USA), 15-19 May 1989). Order Number DE90003484. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The influence of postweld heat treatment (PWHT) on the structure, mechanical properties and fracture characteristics of pulsed, Nd: YAG laser welds in a Ti-14.8 wt % Al-21.3 wt % Nb titanium aluminide has been investigated. Significant microstructure variations within the fusion zone (FZ) of all heat-treated welds were attributed primarily to the influence of local compositional fluctuations on decomposition of the metastable-β microstructure present

in the as-welded FZ. An increase in PWHT temperature promoted a decrease in the maximum FZ hardness and an increase in the longitudinal-weld bend ductility. Correspondingly, the proportion of ductile tearing to cleavage fracture within the FZ increased with an increase in PWHT temperature. 8 refs., 6 figs.

5457 (SERI/STR–211-3584) **Hydrogen radical enhanced growth of solar cells: Phase 1 annual report, June 1, 1987–March 31, 1989.** Borrego, J.M. (Rensselaer Polytechnic Inst., Troy, NY (USA)); Ghandhi, S.K. Solar Energy Research Inst., Golden, CO (USA); Rensselaer Polytechnic Inst., Troy, NY (USA). Oct 1989. 31p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC02-83CH10093. Order Number DE89009497. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report covers work during Phase I of the program entitled "Hydrogen Radical Enhanced Growth of Solar Cells." It involves basic studies of the plasma process and the design and construction of an epitaxial reactor for use with radical species. Experiments have begun on the use of $H^{\cdot}$ and $He^{\cdot}$ for substrate cleaning prior to epitaxy. Work with the reactor was initiated with a series of experiments in the use of radicals for substrate cleaning prior to epitaxial growth. $H^{\cdot}$ was found to be relatively critical, since excessive cleaning resulted in the formation of indium droplets. This was caused by the reaction of InP with $H^{\cdot}$ to form phosphine gas. Using He radicals eliminated this problem. Moreover, their longer lifetime gives them an additional advantage over $H^{\cdot}$, as far as delivery to the growth environment is concerned. We noted that the growth rate of InP, at low temperatures, is erratic from run to run. Prior to conventional growth (without radicals), $He^{\cdot}$ cleaning results in a consistent growth rate at low temperatures. Work with materials grown in a $He^{\cdot}$ (and $H^{\cdot}$) environment also began. Initial results indicate and increased growth rate at low temperatures, but there is some loss in material quality. Work is in progress to quantify these results. An extensive materials characterization effort is also described. 10 refs., 9 figs., 1 tab.

5458 (UCRL–100649) **Benefits from combining electroplating and physical vapor deposition technologies.** Dini, J.W. Lawrence Livermore National Lab., CA (USA). [1989]. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8904292–1: 3. International conferencer on surface modification technologies, Neuchatel (Switzerland), 19 Apr 1989). Order Number DE90002700. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Synergism can be obtained by combining the coating technologies of electroplating and physical vapor deposition. In a number of cases, better coatings and improved adhesion have been obtained with the two processes combined than by using either one by itself. For some applications, parts that could not be fabricated by either process could be produced by combining the two coating methodologies. Quantitative adhesion tests revealed that PVD followed by electroplating produced adherent deposits on Ti, Mo and W. With this combined coating scheme, overall finishing steps are simplified because etching and heating operations are eliminated from the process cycle. Another recent benefit from combining the coating technologies is the demonstrated ability to coat glass with thick copper (1.0 mm) which can be precision machined to an optic surface. These and other examples of combining electroplating and PVD will be discussed in this paper. 14 refs., 6 figs., 2 tabs.

5459 (UCRL–101350) **Evaluation of electroformed copper for shaped charge applications.** Dini, J.W.; Gourdin, W.H. Lawrence Livermore National Lab., CA (USA). Jun 1989. 21p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8910296–1: American Electroplaters and Surface Finishers symposium, Las Vegas, NV (USA), Oct 1989). Order Number DE90002993. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this paper, we present our observations of the behavior of conical shaped charge liners electroformed in a proprietary acid copper sulfate solution and compare these to the dynamic failure observed in rapidly expanding ring experiments with the same material. Although the electroforms performed poorly in both tests, exhibiting low ductility at the high strain rates encountered, results from the two tests agreed quite favorably. This suggests that the electromagnetic ring test, which is considerably less expensive to perform than explosive tests on full size liners, can be used as a screening test for evaluating materials for shaped charge liner applications. Reasons for the poor performance of the copper are hypothesized and plans for future work outlined. 11 refs., 9 figs., 4 tabs.

5460 (UCRL–102036) **Formation of niobium carbides in high-dose carbon-ion-implanted and annealed niobium.** Huang, J.S. Lawrence Livermore National Lab., CA (USA). 30 Oct 1989. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-891119–28: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989). Order Number DE90003601. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Polycrystalline niobium was implanted with 200-keV C^{+} ions to a total fluence of 7×10^{17} carbon ions per cm^2(C/cm^2). Auger electron spectroscopy (AES) analysis showed that the carbon concentration varied from 5 to 50 at. % within a depth of about 4000 Å. Glancing-angle x-ray diffraction analysis (XRDA) and transmission electron microscopy (TEM) analysis indicated that no Nb_2C phase was formed and that a buried fcc NbC layer was formed in the region where carbon content exceeds about 40 at. %. The absence of Nb_2C was attributed to the low diffusivity of carbon atoms and the fact that it could form only as an intermetallic compound. As a result of the TEM analysis and the fact that the diffusivity of carbon is very small, the formation of NbC is described as a type of diffusionless martensitic transformation. When the implanted samples were annealed at 1273 K for 1 h, the implanted carbon redistributed, the NbC phase disappeared, and an orthorhombic Nb_2C phase formed as spherical precipitates. 14 refs., 3 figs., 1 tab.

5461 **Interfaces, superlattices, and thin films.** Materials Research Society symposia proceedings. Volume 77. Dow, J.D.; Schuller, I.K. 811p. Materials Research Society, Pittsburgh, PA (1987). (CONF-8612131–: Materials Research Society symposium on interfaces, superlattices and thin films, Boston, MA (USA), 1-6 Dec 1986).

This book covers the proceedings of the Materials Research Society Symposia. Topics covered include Elastic properties of superlattices; Superconducting metallic superlattices; and Molecular-dynamics simulation of thin-film growth.

5462 **Progress toward a crystal streak camera using tungsten bronze crystals for the electrooptic material.** Jelsma, L.F. (Lawrence Livermore National Lab., Electronics Engineering Dept., PO Box 808, Livermore, CA (US)); Lowry, M.E.; Neurgaonkar, R.R.; Cory, W.K.; Welch, H.W. pp. 380 of Optoelectronic materials, devices, packaging, and interconnects. Batchman, T.E.; Carson, R.F.; Gallawa, R.L.; Wojtunik, H.J SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1987). DOE Contract W-7405-ENG-48. (CONF-8708229–: Optoelectronic materials, devices, packaging, and interconnects, San Diego, CA (USA), 19-21 Aug 1987).

Currently, The Hamamatsu and Sandia Corporations use lithium niobate ($LiNbO_3$) in their crystal streak cameras. However, these systems have low resolution due to the low electrooptic coefficient of $LiNbO_3$, 30×10^{-12}, which requires excessive voltage drives for the system. For a practical system, new tungsten bronze crystals such as barium niobate [$Sr_{1-chi}Ba_{chi}Nb_2O_6$, or SBN:1-chi (%) for short] must be used to achieve higher resolution and lower voltage requirements. Electrooptic coefficients of 400×10^{-12} m/V for SBN:60 and 1400×10^{-12} m/V for SBN:75 give improvements in resolution of 13 and 47, respectively. In this paper, the authors discuss the highlights of a light deflector developed at Lawrence Livermore National Laboratory (LLNL) for a streak camera that uses tungsten bronze crystals grown at Rockwell International Science Center. They address the design and fabrication of these crystals and include experimental results from their deflector experiment, the purpose of which is to determine the feasibility and expected performance of the crystal streak camera using tungsten bronze crystals.

5463 **An ion beam simulation of the swelling of U_3Si.** Allen, C.W. (Argonne National Lab., Argonne, IL (US)); Birtcher, R.C.; Rehn, L.E.; Hofman, G.L. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA

(1988). DOE Contract W-31-109-ENG-38. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

Uranium intermetallics are under consideration as possible low-enrichment reactor fuels. These materials divide into two classes with regard to dimensional stability during their service lifetime: those which suffer extreme dimensional growth and those which do not. It has been suggested that the rapid-swelling materials are those that become glassy under irradiation while the low-swelling materials are those that remain crystalline. The structural and dimensional stabilities of U_3Si (depleted uranium) have been investigated as a function of temperature during Kr irradiation by in situ HVEM observations. Below 550 K, this material becomes glassy during 1.0 MeV Kr irradiation. Prolonged irradiation at 475 K also leads to rapid darkening of the TEM bright field image of the specimen, growth of the initial perforation at rates which far exceed those due to sputtering, and formation of additional thin areas and holes. Irradiation at 615 K does not result in observable image darkening or rapid growth of the initial perforation. The mechanism of the irradiation-induced growth of the glassy material does not involve gas precipitation but rather may involve deformation by viscous flow assisted by the defects generated during irradiation.

5464 Crystallization and melting in multilayered structures. Sevenhans, W. (Lab. for Vaste Stof-Fysika en Magnetisme, Katholieke Univ., Leuven, B-3030, Leuven (BE)); Vanderstraeten, H.; Lacquet, J.P.; Bruynseraede, Y.; Homma, H.; Schuller, I.K. pp. 365 of Multilayers: Synthesis, properties and non-electric applications. Barbee, T.W. Jr.; Spaepen, F.; Greer, L. Materials Research Society, Pittsburgh, PA (1988). (CONF-8711143–: Symposium on multilayers: synthesis, properties and nonelectronic applications, Boston, MA (USA), 30 Nov - 4 dec 1987).

The stability of Pb/Ge and Pb/C multilayers has been studied over a broad temperature range by x-ray diffraction experiments. In the Pb/Ge system an amorphous to microcrystalline phase transformation of the Ge-layers was already observed at $\simeq 100^0$C. This transition destroys the modulation structure and improves the Pb(111) texture. In the Pb/C multilayers, the layered structure was still present at temperatures higher than the melting temperature of Pb. Contrary to recent publications, no depression of the melting temperature of the two-dimensional Pb layers could be observed.

5465 Crystallization and glass formation in electron and laser beam irradiated Cu-Zr alloys. Huang, J.S. (Lawrence Livermore National Lab., Livermore, CA (US)); Kaufmann, E.N.; Wall, M.A.; Olsen, B.L. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). DOE Contract W-7405-ENG-48. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

Four Cu-Zr alloys, $Cu_{56}Zr_{44}$, $Cu_{50}Zr_{50}$, $Cu_{47}Zr_{53}$, and $Cu_{33}Zr_{67}$, were surface melted with electron and pulsed laser beams to compare their kinetics of nucleation, growth and glass formation. It was observed that the ease of glass formation increased in the order: $Cu_{33}Zr_{67}$, $Cu_{47}Zr_{53}$, $Cu_{56}Zr_{44}$, and $Cu_{50}Zr_{50}$. The nucleation and regrowth produced different metastable phases. At the equiatomic composition, the preferred phase is a CsCl-type (B2) BCC structure. As the composition deviates from this, the preferred phase is either orthorhombic or tetragonal with a much larger unit cell not previously reported in the literature. The maximum growth velocity of these metastable phases was found to be about 0.025 m/s. The slow kinetics are responsible for the ease of glass formation in these systems.

5466 Brazing of ceramic and graphite to metal in the fabrication of ICRF antenna and feedthrough components. Schechter, D.E. (Oak Ridge National Lab., PO Box Y, Oak Ridge, TN (USA)); Sluss, F.; Hoffman, D.J. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract AC05-84OR21400. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

Fabrication of some of the more critical components of ion cyclotron range of frequencies (ICRF) antenna and feedthrough assemblies has involved the brazing of alumina ceramic and graphite to various metals. Copper end pieces have been successfully brazed to alumina cylinders for use in feedthroughs for TEXTOR and in feedthroughs and capacitors for a Tokamak Fusion Test Reactor (TFTR) antenna. Copper-plated Inconel rods and tubes have been armored with graphite for construction of Faraday shields on antennas for Doublet III-I and TFTR. Details of brazing procedures and test results, including rf performance, mechanical strength, and thermal capabilities, are presented.

5467 Microstructure and composition of 304 stainless steel implanted with Ti and C. Follstaedt, D.M. (Sandia National Labs., Albuquerque, NM (USA)); Knapp, J.A.; Pope, L.E. *Nuclear Instruments and Methods in Physics Research. Section B: Beam Interactions with Materials and Atoms (Netherlands)*, 42(2): 205-211 (Jun 1989).

The microstructure and composition of surface alloys formed by implanting Ti and C into 304 stainless steel are examined for a range of Ti fluences, both with and without additional implanted C. The resulting amorphous layers are found to contain TiC precipitates, apparently with some Cr on Ti lattice sites, when the metal-atom fraction of Ti+Cr exceeds 55%. The depth profiles of Ti and C are measured, and the amounts of C incorporated into the alloys during Ti implantation are determined. Small amounts of H are also incorporated during the high-fluence Ti implantations. Thicker amorphous layers than those resulting from Ti implantation alone can be formed when additional C is implanted either before or after the Ti. (orig.).

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Refer also to citation(s) 4868, 5224, 5359, 5411, 5446, 5453, 5454, 5466, 5662, 5790, 5901, 6220, 6221, 6239, 6240, 6349, 6361

5468 (AD-A–211308/2/XAB) **Effect of annealing conditions on the structural and superconducting properties of Y-Ba-Cu-O films.** Ryu, J.; Huang, Y.; Vittoria, C.; Ryder, D.F.; Marzik, J.V. Army Materials Research Agency, Watertown, MA (USA). Materials Technology Lab. May 1989. 17p. (MTL-TR–89-41). Available from NTIS, PC A03/MF A01.

The effect of various annealing treatments on ion-beam sputter-deposited $Y_1Ba_2Cu(y)O(7-x)(y=3$ and 5) amorphous thin films was studied using scanning electron microscopy (SEM), X-ray diffraction and dc resistivity measurements. SEM analysis showed that the morphology of the films were clearly divided into three categories: an equiaxial grain structure, a well-oriented grid-like microstructure and a textured platelet structure. The equiaxial grain structure (random orientation according to x-ray diffraction measurements) was obtained when the film was annealed at slow heating and cooling rates in an oxygen atomosphere. The grid-like microstructure (b/c axes oriented normal to the plane) was obtained in Cu-rich composition (y=5) by rapid thermal annealing. A textured platelet microstructure (c axis oriented normal to the plane) was obtained using slow heating rates and by carefully controlling the gas environment at the temperature region near the orthorhombic-tetragonal transition. Thus, it was demonstrated the ability to control the morphology and orientation of the film by varying the annealing process.

5469 (AD-A–211315/7/XAB) **Oxide ceramic fibers by the sol-gel methods. Final report, December 1986-February 1988.** Mackenzie, J.D.; Ono, K. California Univ., Los Angeles, CA (USA). 10 Feb 1989. 79p. Available from NTIS, PC A05/MF A01.

Sol-gel processing has many advantages over traditional powder based ceramic processing. These advantages include better homogeniety, higher purity and low-temperature synthesis. Additionally, the sol-gel process is the only low temperature process available to make high-temperature stable oxide fibers. Most of these fibers cannot be formed by drawing via the traditional melt method. This report includes research conducted on the preparation of lanthanum chromite fibers. Lanthanum chromite's high-temperature stability was enhanced by coating with alumina. Additionally, at test high temperatures, several commercial fibers, including alumina fibers were tested with this rig.

5470 (AD-A–211490/8/XAB) **Surface, interface, and bulk properties of high-T_c superconductors. Final report, 30 September 1987-29 April 1989.** Spicer, W.E.; Shen, Z.X.; Lindberg, P.;

Dessau, D.; Wells, B. Stanford Univ., CA (USA). Stanford Electronics Labs. 30 Jun 1989. 12p. Available from NTIS, PC A03/MF A01.

The authors performed extensive studies of the $Bi_2Sr_2CaCu_2O_8$ material ever since its discovery in early 1988. Single crystals, polycrystalline pellets and thin film samples of the $Bi_2Sr_2CaCu_2O_8$ material were examined using various photoemission related techniques. Especially the single crystalline $Bi_2Sr_2CaCu_2O_8$ material was found to have an extraordinary inertness in ultrahigh vacuum conditions, allowing a detailed examination of the surface electronic structure. Consequently, most of our investigations were focused on the single crystalline materials. Low-Energy Electron Diffraction (LEED) was used to confirm the single crystallinity of the in situ cleaved crystals of $Bi_2Sr_2CaCu_2O_8$. Sharp diffraction spots indicative of long range periodicity were observed. The observed LEED pattern showed that the $Bi_2Sr_2CaCu_2O_8$ material preferentially cleaves parallel to the a-b plane. In addition, a superstructure was seen extending along one of the symmetry axes in the a-b plane. The superstructure was found to have a periodicity about 5 times as long as the cell dimensions of the a and b axes, in agreement with the bulk structure.

5471 (AD-A–211511/1/XAB) **High-temperature superconducting compounds. Technical report, 1 September 1987-28 February 1989.** Goldman, A.M.; Mecartney, M.L. Minnesota Univ., St. Paul, MN (USA). 31 Mar 1989. 14p. Available from NTIS, PC A03/MF A01.

High-T(c) superconductors were investigated in both bulk and thin-film form. Investigations were carried out on the magnetic properties of both polycrystalline and single crystal forms of $YBa_2Cu_3O_7$ focussing on time-dependent effects. Single crystals of this material have been studied using scanning tunneling microscopy. Techniques for fabricating thin films were developed. These include sputtering using spherical targets and co-evaporation using pure ozone and an oxidant. The latter permits the in-situ formation of films without any post-deposition annealing step. Superconducting fluctuations and the Kosterlize-Thouless transition were studied in the Tl-Ba-Ca-Cu-O films.

5472 (AD-A–211651/5/XAB) **New mechanism for toughening ceramic materials. Final report, 15 July 1987-14 December 1988.** Cutler, R.A.; Virkar, A.V. Ceramatec, Inc., Salt Lake City, UT (USA). 19 May 1989. 98p. (CERMATEC–8961701). Available from NTIS, PC A05/MF A01.

A 14-month study by Ceramatec, with a subcontract to the University of Utah, was initiated in order to determine if ferroelastic switching contributes to toughening in ceramic materials. Domain switching in ZrO_2 single crystals (heat treated to minimize transformation) at 1400 C was used to show that ferroelastic switching is a process that occurs at temperatures in excess of the monoclinic-to-tetragonal transformation temperature. These data, coupled with fracture toughness measurements of 8 MPa.m 1.2 at 1000 C, show that ferroelastic toughening has the potential for toughening at temperatures in excess of that possible by transformation toughening. Experiments on PZT, SrZrO3 and Gd_2 $(MoO_4)_3$ were used to show that ferroelastic switching can contribute to toughening. The time dependence of switching was demonstrated using PZT ceramics. Dopants were added to polycrystalline TZP materials in order to substantially increase their fracture toughness. In the case of SrO additions, strontium aluminate platelets, formed in-situ during sintering, contributed to toughness.

5473 (AD-A–211742/2/XAB) **Preliminary assessment of neutron radiography for detecting inhomogeneities in ceramics. Technical report.** Corbin, N.D.; Pujari, V.K.; Antal, J.J.; Marotta, A.S. Army Materials Research Agency, Watertown, MA (USA). Materials Technology Lab. Aug 1987. 21p. (MTL-TR–89-71). Available from NTIS, PC A03/MF A01.

Pub. in Proceedings of the Joint Conference on Nondestructive Testing of High-Performance Ceramics, 114-127(25-27 Aug 1987).

As a result of the availability of small neutron sources, neutron radiography is becoming a more accessible tool for materials evaluation. Prior to the development of these sources, nuclear reactors were needed for neutron radiography. The attenuation coefficients of the elements for neutrons are very different from their X-ray attenuation coefficients; for example, neutrons interact strongly with hydrogen atoms. As a result, one can readily detect the spatial distribution of hydrated species and polymers within a ceramic body. Potential applications for neutron radiography are found in evaluating drying and binder-removal processes from ceramic compacts. This paper illustrates the use of neutron radiography for detecting voids, polymer inclusions, and binder distributions in SiC, Si_3N_4 and $A_{12}O_3$ based materials.

5474 (BNL–43461) **X-ray absorption studies of $YBa_2Cu_3O_{6+x}$, $La_{2-x}Sr_xCuO_4$, and $Nd_{2-x}Ce_xCuO_4$.** Lin, C.L. (Brookhaven National Lab., Upton, NY (USA)); Qiu, S.L.; Chen, J.; Strongin, M.; Crow, J.E.; Chu, C.W. Brookhaven National Lab., Upton, NY (USA). [1989]. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-891093–15: 36. American Vacuum Society national vacuum symposium, Boston, MA (USA), 23-27 Oct 1989). Order Number DE90003640. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

O K-edge absorption studies show that the density of O 2p empty states near the Fermi level increases with increasing oxygen content for $YBa_2Cu_3O_{6+x}$, and Sr concentration in $La_{2-x}Sr_xCuO_4$. With Zn substitution for Cu in $YBa_2Cu_3O_7$, $T_c$does not correlate with the density of O 2p empty states. In this case Tc dramatically decreases with Zn substitution while the pre-edge feature remains unchanged. The O K-edge spectrum of $Nd_{2-x}Ce_xCuO_4$ barely changes from the undoped, insulating, to the Ce doped superconducting sample. The lack of unoccupied O 2p states near the Fermi level in this case is consistent with naive expectations for electron-doping. 21 refs., 4 figs.

5475 (CONF-890426–32) **Processing and properties of nanophase oxides.** Eastman, J.A.; Liao, Y.X.; Narayanasamy, A.; Siegel, R.W. Argonne National Lab., IL (USA). [1989]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Spring meeting of the Materials Research Society; San Diego, CA (USA); 24-28 Apr 1989. Order Number DE90003826. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Nanophase oxides (Al_2O_3, MgO, ZnO and TiO_2), with typical grain sizes in the range 2–20 nm, have been synthesized by the condensation of ultrafine particles in a convective inert gas followed by their collection and in-situ consolidation in vacuum at ambient temperature. These new materials, owing to the reduced scale of their grains along with the enhanced cleanliness of their grain boundaries, are found to have significantly improved properties relative to those of their coarser-grained, conventionally-prepared counterparts. Nanophase rutile (TiO_2) with an initial mean grain diameter of 12 nm, for example, has been found to sinter at 400 to 600°C lower temperatures than conventional rutile powders, without the need for compacting or sintering aids, while retaining a small grain size. Additionally, the importance of the extremely clean surfaces obtained with the gas condensation method has been demonstrated by comparing the sintering behavior of powders with and without air exposure prior to consolidation. The research completed on the processing and properties of nanophase ceramics is reviewed, and the potential for engineering advanced ceramics using the nanophase processing method is discussed. 20 refs., 5 figs.

5476 (CONF-890770–7) **Development of NMR [Nuclear Magnetic Resonance] imaging probes for advanced ceramics.** Gopalsami, N.; Forster, G.A.; Dieckman, S.L.; Ellingson, W.A.; Botto, R.E. Argonne National Lab., IL (USA). Sep 1989. 18p. Sponsored by U.S. DOE Conservation & Renewable Energy; U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. From Conference on review of progress in quantitative NDE; Brunswick, ME (USA); 23-28 Jul 1989. Order Number DE90003812. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this paper is to present the design and test results of a special imaging probe built at Argonne for ceramics characterization. The imaging probe is designed to be used in an 89-mm vertical-bore, 2.35-T superconducting magnet in conjunction with a Bruker CXP-100 spectrometer. The probe must accommodate samples up to 28 mm in diameter, in accordance with our present requirements. The probe includes an RF coil for excitation and detection of the nuclear signals, and a set of gradient coils to create gradient fields with respect to the x, y, and z spatial coordinates. At high field strengths, the gradient coils will generate

considerable heat owing to resistive losses; hence, a provision for cooling the probe is included. 7 refs., 10 figs.

5477 (CONF-891119–17) **Preparation, structure and properties of VO_x and TiO_2 thin films by MOCVD.** Chang, H.L.M.; Parker, J.C.; You, H.; Xu, J.J.; Lam, D.J. Argonne National Lab., IL (USA). Nov 1989. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Materials Research Society fall meeting; Boston, MA (USA); 27 Nov - 2 dec 1989. Order Number DE90003566. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Titanium and vanadium oxide thin films have been prepared in a cold wall low pressure MOCVD system for the study of MOCVD processing of epitaxial oxide films. Films were deposited on Si(111) and sapphire (0001) and (1120) at temperatures from 400 to 800°C. Processing parameter-structure-property relationship was examined in detail and the result is presented. 4 refs., 7 figs., 1 tab.

5478 (CONF-891119–19) **Processing and fabication of $YBa_2Cu_4O_8$ and $YBa_2Cu_4O_8/YBa_2Cu_3O_x$ composites.** Balachandran, U. (Argonne National Lab., IL (USA)); Biznek, M.E.; Goretta, K.C.; Veal, B.W.; Poeppel, R.B.; Mason, T.O. Argonne National Lab., IL (USA). Nov 1989. 9p. Sponsored by U.S. DOE Conservation & Renewable Energy; U.S. DOE Energy Research; National Science Foundation. DOE Contract W-31109-ENG-38. From Materials Research Society fall meeting; Boston, MA (USA); 27 Nov - 2 dec 1989. Order Number DE90003559. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Powders of $YBa_2Cu_4O_8$("124") were prepared via solid state reaction of Y_2O_3, $BaCO_3$, and CuO. The mixed precursors were heated in flowing oxygen of reduced total pressure, followed by cooling and annealing at 750°C under ambient pressure oxygen. The procedure produced orthorhombic 124 as the main phase with $YBa_2Cu_3O_x$ ("123") as a minor impurity phase. The phase purity improved and nearly phase-pure 124 was obtained upon annealing the as-calcined powder in flowing oxygen at 800°C. 12 refs., 3 figs.

5479 (CONF-891119–24) **Characterization of MOCVD [metal organic chemical vapor deposition] grown epitaxial ceramic oxide thin films.** Parker, J.C.; Chang, H.L.M.; Xu, J.J.; Lam, D.J. Argonne National Lab., IL (USA). Nov 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Materials Research Society fall meeting; Boston, MA (USA); 27 Nov - 2 dec 1989. Order Number DE90003561. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Characterization of TiO_2 films grown by the MOCVD technique using micro-Raman scattering. The effects of processing parameters on the film composition and morphology have been investigated. The micro-Raman technique is shown to be a useful tool for characterizing oxide thin films grown by the MOCVD technique. 10 refs., 3 figs.

5480 (CONF-891119–27) **Magnetic flux pinning in $YBa_2Cu_3O_7$ films.** Kerchner, H.R.; Feenstra, R.; Thomson, J.O.; Thompson, J.R.; Christen, D.K.; Sekula, S.T.; Boatner, L.A. Oak Ridge National Lab., TN (USA). Nov 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Materials Research Society fall meeting; Boston, MA (USA); 27 Nov - 2 dec 1989. Order Number DE90003709. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The magnetic hysteresis was studied for $YBa_2Cu_3O_7$ films of different epitaxial orientations on single-crystal $SrTiO_3$ and $KTaO_3$ substrates. Deposition by coevaporation of Y, BaF_2, and Cu was followed by annealing in flowing, wet oxygen at 800-850°C. The critical current density J_c deduced from magnetic hysteresis loops was compared with four-terminal transport-current results. Thermally activated magnetic flux flow was manifest in the audio-frequency data. J_c fits a scaling law similar to one used for describing Nb_3Sn and other A15 materials. 7 refs., 3 figs.

5481 (CONF-891124–2) **Superconductivity in $Ba_{1-x}K_xBiO_3$.** Degani, M.H.; Kalia, R.K.; Vashishta, P. Argonne National Lab., IL (USA). Oct 1989. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 7. international conference on solid-state ionics; Hakone (Japan); 5-9 Nov 1989. Order Number DE90003781. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Phonon density-of-states (DOS) of insulating $BaBiO_3$ and superconducting $Ba_{0.6}K_{0.4}BiO_3$ is studied using effective interaction potentials and molecular dynamics (MD) method. MD Results are in good agreement with the inelastic neutron scattering and electron tunneling experiments. Calculated oxygen isotope effect using the Eliashberg gap equations is also in good agreement with the experiments. Cumulative evidence based on the neutron scattering, tunneling, and the isotope effect suggests that this material is a normal BCS electron-phonon superconductor. 11 refs. , 3 figs., 2 tabs.

5482 (CONF-891208–1) **Crack tip toughening by inclusions with pairs of shear transformations.** Chang, S.-J. (Oak Ridge National Lab., TN (USA)); Becher, P.F. Oak Ridge National Lab., TN (USA). [1989]. 35p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Winter annual meeting of the American Society of Mechanical Engineers; San Francisco, CA (USA); 10-15 Dec 1989. Order Number DE89007845. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The deviatoric transformation strain of an inclusion is modeled by applying an equivalent distribution of dislocations along a surface which exhibits a discontinuous change in the transformation strains. This method is applied to qualitatively model the twin structures generated in transformation toughened ceramics. For this case, the transformation shear strain of the inclusion is assumed to consist of a number of symmetrical pairs of (twinning) shears in a rectangular grain. The elastic energy is derived and expressed in terms of elementary functions. With one pair of shears, the inclusion induced toughening effect in the presence of a crack is calculated by applying a recent solution of the crack-dislocation interaction problem. Numerical results show that the toughening due to the inclusion (as compared to that due to dilatation) is not negligible if the inclusion is located within a distance equal to several grain sizes from the crack tip. Moreover, the toughening depends strongly on the orientation of the inclusion relative to the crack. 14 refs., 7 figs.

5483 (CONF-8910120–5) **Processing $YBa_2Cu_3O_x$ wires in O_3/O_2.** Dorris, S.E.; Goretta, K.C.; Hajyousif, B.; Balachandran, U.; Dusek, J.T.; Shi, D.; Poeppel, R.B. Argonne National Lab., IL (USA). Sep 1989. 8p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From 1. international ceramic science and technology congress; Anaheim, CA (USA); 31 Oct - 3 nov 1989. Order Number DE90003570. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Plastically extruded wires were heat treated in O_2 or a mixture of O_2/3% O_3. The presence of O_3 during the burnoff of organics resulted in measurable increases in critical current density(J_c), while post-sintering annealing in the O_3/O_2 mixture rather than in O_2 had no effect. Maximum zero-field J_c values exceeded 1000 A/cm^2. 14 refs., 1 fig., 1 tab.

5484 (CONF-8910120–6) **Diffusion and processing of $YBa_2Cu_3O_x$.** Goretta, K.C.; Poeppel, R.B.; Shi, D.; Chen, Nan; Rothman, S.J.; Routbort, J.L. Argonne National Lab., IL (USA). Oct 1989. 13p. Sponsored by U.S. DOE Conservation & Renewable Energy; U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 1. international ceramic science and technology congress; Anaheim, CA (USA); 31 Oct - 3 nov 1989. Order Number DE90003569. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Data have been compiled on diffusion and diffusion-related properties of $YBa_2Cu_3O_x$. Results show that optimum superconducting properties are obtained when $YBa_2Cu_3O_x$ is processed in reduced oxygen pressures. In addition, because of competing effects of temperature and stoichiometry, post-sintering oxygen annealing is best conducted in stages over a range of temperatures, rather than at low temperature only. Recommendations for processing atmospheres, temperatures, and times are offered. 23 refs., 3 figs., 1 tab.

5485 (ENEA-RT-FUS–88-20) **High temperature superconducting materials and their prospects for large, high field, magnetic coils.** Paterno', G. ENEA, Frascati (Italy). Centro Ricerche Energia. Apr 1989. 20p. (CONF-880929–13: 15. symposium on fusion technology, Utrecht (Netherlands), 19-23 Sep 1988).

Order Number DE90724691. Available from NTIS (US Sales Only), PC A03/MF A01.

Invited lecture presented at the 15th symposium on fusion technology (Utrecht 19-23 September 1988).

The possibility of using liquid nitrogen, at 77 K, as a cooling medium instead of liquid helium (at 4.2 K) opens new possibilities for practical applications of superconductivity. Liquid nitrogen is cheaper and more abundant than liquid helium. Furthermore, cryogenic problems are more simple at the temperature of liquid nitrogen. In this paper, a brief review of the new high critical temperature supeconductors (La-Ba-Cu-O compounds of Bednorz and Muller and Y-Ba-Cu-O compounds of Wu and Chu) is presented. The superconducting properties are considered with particular attention given to magnetic field behaviour and transport critical current. The possibility of large scale applications of this new class of materials is briefly discussed. In order to be useful for large, high field, magnetic coils, the new materials must be fabricated in a form of wires or tapes with a critical current density of the order of 10^5 A/ square centimeters in a magnetic field higher than 10 T, at 77 K. The intrinsic properties of the new superconducting oxides are very close to these values. However, at present, the performances of wires and bulk sintered ceramic materials are very far from those of conventional niobium-tin superconducting wires.

5486 (ENEA-RT-FUS--88-24) **High temperature superconductivity in ceramic materials.** Paterno', G. ENEA, Frascati (Italy). Centro Ricerche Energia. May 1989. 26p. (CONF-8809310--1: International workshop on properties of ceramics and their measurements, Ustica (Italy), 12-16 Sep 1988). Order Number DE90724611. Available from NTIS (US Sales Only), PC A03/MF A01.

Presented at the 2nd international workshop on properties of ceramics (Ustica, 12-16 September 1988).

The discovery of superconductivity (at 40 K by Bednorz and Muller at 90 K by Wu and Chu) in ceramic oxides, has generated a tremendous amount of work in the field of high temperature superconducting materials. Such activity has led recently to the identification of new superconductiong copper oxides with no rare earths. In these compounds, which are Bi-Ca-Sr-Cu-O and Tl-Ca-Ba-Cu-O, the superconducting transition can occur at a temperature as high as 110 K and 125 K respectively. All the high temperature superconducting materials so far discovered, are metallic copper oxides with perovskite like structures. However very recently, superconducting transition at 30 K has been reported in a Ba-K-Bi-O compound, which has a three dimensionally connected bismuth-oxygen array and no copper atoms. The family of the superconducting ceramic oxides is becoming more and more populated. In this paper, a general overview of the class of superconducting ceramic oxides will be reported. Their structure and physical properties will be discussed. As far as their superconducting properties are concerned, attention will be devoted to transport critical currents and magnetic field behaviour that are of fundamental importance in applications of the new superconducting ceramic materials.

5487 (IAE--4552-11) **On the irradiation action on the structure-dynamic chracteristics of uranium dioxide.** Lemekhov, S.E. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1988. 9p. (In Russian). Order Number DE90610776. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The effect of irradition factors such as irradiation temperature, formation of the network of track lines and density of long radiation-induced efects, on the temperature dependences of the specific energy of integrain boundaries and edge angle of integrain gas inclusions in uranium dioxide under reactor irradiation is considerd in terms of the track model of ion explosion. It is shown that the effect of radiation factors can essentially change quantitatively the values of desired chracteristics comparing with their values for unirradited fuel. 15 refs.

5488 (IAE--4576-11) **Dynamic features of densofication of uranium dioxide under irradiation.** Lemekhov, S.E.; Timashov, V.V. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1988. 32p. (In Russian). Order Number DE90610777. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The dynamical features of densification of reactor-irradiated uranium dioxide have been analyzed. The main correlations betwen the rates, resulting densification level and initial structural characteristics of fuel pellets and radiation conditions during irradiation are shown. Requirements on adequate modelling of this process have been formulated, which permit conclusions to be made on predictability of the models known in the literature. Reasons are given for the necessary performance of in-pile experiments with domestic types of fuel pellets. 29 refs.; 3 figs.; 2 tabs.

5489 (INIS-BR--1752) **Advanced Ceramics.** Secretaria Estadual de Ciencia e Tecnologia, Rio de Janeiro, RJ (Brazil). 1989. 356p. (In Portuguese). (CONF-8908187--: 2. state meeting of new materials and 1. Florida-Brazil seminar on materials, Rio de Janeiro (Brazil), 2-4 Aug 1989). Order Number DE90608004. Available from NTIS (US Sales Only), PC A16/MF A01 - OSTI; INIS.

The First Florida-Brazil Seminar on Materials and the Second State Meeting about new materials in Rio de Janeiro State show the specific technical contribution in advanced ceramic sector. The others main topics discussed for the development of the country are the advanced ceramic programs the market, the national technic-scientific capacitation, the advanced ceramic patents, etc. (C.G.C.).

5490 (INIS-BR--1752, pp. 79-82) **Electro-electronics ceramics/superconductors.** Muccillo, R. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). Secretaria Estadual de Ciencia e Tecnologia, Rio de Janeiro, RJ (Brazil). 1989. (In Portuguese). (CONF-8908187--: 2. state meeting of new materials and 1. Florida-Brazil seminar on materials, Rio de Janeiro (Brazil), 2-4 Aug 1989). In *Advanced Ceramics.* Order Number DE90608004. Available from NTIS (US Sales Only), PC A16/MF A01 - OSTI; INIS.

The main results obtained in IPEN laboratory with the ceramics solids electrolytes based in thorium and zirconium oxides with aluminium oxides, and with superconducting ceramics based in Bi-Sr-Ca-Cu-O are presented. (C.G.C.).

5491 (INIS-BR--1752, pp. 133-167) **Study of brazilian market of advanvced ceramics.** Veiga, M.M. (Paulo Abid Engenharia S.A., Sao Paulo, SP (Brazil)); Soares, P.S.M.; Sliva, A.P. da; Alvarinho, S.B. Secretaria Estadual de Ciencia e Tecnologia, Rio de Janeiro, RJ (Brazil). 1989. (In Portuguese). (CONF-8908187--: 2. state meeting of new materials and 1. Florida-Brazil seminar on materials, Rio de Janeiro (Brazil), 2-4 Aug 1989). In *Advanced Ceramics.* Order Number DE90608004. Available from NTIS (US Sales Only), PC A16/MF A01 - OSTI; INIS.

The brazilian actual market survey of advanced ceramics, divided in sectors according to their function is described. The electroelectronics, magnetics, optics, mechanics and nuclears ceramics are presented. A forecasting of the brazilian market in advanced ceramics are also mentioned. (C.G.C.).

5492 (INIS-BR--1752, pp. 171-178) **Raw material versus processing.** Berg, E.A.T. (Lorenzetti Porcelana Industrial Parana S.A. (Brazil)). Secretaria Estadual de Ciencia e Tecnologia, Rio de Janeiro, RJ (Brazil). 1989. (In Portuguese). (CONF-8908187--: 2. state meeting of new materials and 1. Florida-Brazil seminar on materials, Rio de Janeiro (Brazil), 2-4 Aug 1989). In *Advanced Ceramics.* Order Number DE90608004. Available from NTIS (US Sales Only), PC A16/MF A01 - OSTI; INIS.

Some brazilian aspects related with the obtainment of raw materials for advanced ceramic products are described. The necessity of import raw materials by the advanced ceramic industries is mentioned, generating dangerous depedence for the country. The brazilian mineral reserves for using in raw materials of advanced ceramic are also cited. (C.G.C.).

5493 (INIS-BR--1752, pp. 186-194) **Microwaves absorption in superconducting materials.** Biasi, R.S. de (Instituto Militar de Engenharia, Rio de Janeiro, RJ (Brazil)); Fernandes, A.A.R.; Pereira, R.F.R. Secretaria Estadual de Ciencia e Tecnologia, Rio de Janeiro, RJ (Brazil). 1989. (In Portuguese). (CONF-8908187--: 2. state meeting of new materials and 1. Florida-Brazil seminar on materials, Rio de Janeiro (Brazil), 2-4 Aug 1989). In *Advanced Ceramics.* Order Number DE90608004. Available from NTIS (US Sales Only), PC A16/MF A01 - OSTI; INIS.

Microwaves absorption measures in two superconductors ceramics systems, Y-Ba-Cu-O and Bi-Sr-Ca-Cu-O are compared with similars datas obtained in the same band of temperature by a conventional method, mutual inductance. The results suggest that the microwaves absorption can be used as single and non-destructive method for investigating the properties of ceramics superconductors. (C.G.C.).

5494 (INIS-BR–1752, pp. 195-203) **Lead titanate ceramics for piezoelectrics transducers.** Garcia, D. (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica); Eiras, J.A. Secretaria Estadual de Ciencia e Tecnologia, Rio de Janeiro, RJ (Brazil). 1989. (In Portuguese). (CONF-8908187–: 2. state meeting of new materials and 1. Florida-Brazil seminar on materials, Rio de Janeiro (Brazil), 2-4 Aug 1989). In *Advanced Ceramics.* Order Number DE90608004. Available from NTIS (US Sales Only), PC A16/MF A01 - OSTI; INIS.

The preparation and the characterization of lead titanate ceramics, doped with La and La + Mn, aiming their utilization as piezoelectrics transducers are presented. The electromechanics constant at environment temperature and the influence of polarization field in dielectric constant $E_{33}T/Eo$ of the dielectric dissipation factor FD and the electromechanics coupling factors are also mentioned. (C.G.C.).

5495 (INIS-BR–1752, pp. 247-273) **Survey of the patents intensity in advanced ceramics.** Rodrigues, C.S. (Instituto Nacional da Propriedade Industrial, Rio de Janeiro, RJ (Brazil)); Oliveira, E.C. de; Pencinato, M.V.; Bandeira, R.J.; Ribeiro, E. Secretaria Estadual de Ciencia e Tecnologia, Rio de Janeiro, RJ (Brazil). 1989. (In Portuguese). (CONF-8908187–: 2. state meeting of new materials and 1. Florida-Brazil seminar on materials, Rio de Janeiro (Brazil), 2-4 Aug 1989). In *Advanced Ceramics.* Order Number DE90608004. Available from NTIS (US Sales Only), PC A16/MF A01 - OSTI; INIS.

A survey about a sectorial diagnostic of advanced ceramics, using patents of the Industrial Properties National Institute, as a reference documentation is presented. The mains points for generating technology in 80 decade are identified, by the institutions/company titularies of patents. (C.G.C.).

5496 (INIS-BR–1752, pp. 219-233) **Use of microwave heating in advanced ceramics processing.** Freitas, C.T. de (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). Secretaria Estadual de Ciencia e Tecnologia, Rio de Janeiro, RJ (Brazil). 1989. (In Portuguese). (CONF-8908187–: 2. state meeting of new materials and 1. Florida-Brazil seminar on materials, Rio de Janeiro (Brazil), 2-4 Aug 1989). In *Advanced Ceramics.* Order Number DE90608004. Available from NTIS (US Sales Only), PC A16/MF A01 - OSTI; INIS.

Experiments carried out at IPEN are presented, involving advanced ceramics microwave processing. Drying, binder removal, calcing and sintering of materials such as oxides and other compounds of aluminium, zirconium, uranium, beryllium and rare earths were developed in laboratory scale, 2,42 GHz. Modifications of the available commercial furnaces are described; they permitted to obtain temperatures higher than 400 C. Temperatures over 800 C were reached in quartz chambers surrounded by vermiculite; 1200 C was attained with the utilization of the commercial refractory 'Fiberfrax'. The microwave furnace was operated inside a gas cooled glove-box, with nitrogen, argon and air as heat treatment atmospheres. At the microwave frequency used the experiments, although in a laboratory scale, indicate that uranium compounds microwave drying has competitive potential in relation to other more usual procedures. It is discussed the possibility of using microwave heating in a near future in Brazil, for advanced and traditional ceramics processing. (author).

5497 (INIS-BR–1752, pp. 234-246) **Sintering of zirconia in high-pressure.** Kunrath, A.O. (Rio Grande do Sul Univ., Porto Alegre (Brazil)); Strohaecker, T.R.; Pereira, A.S.; Jornada, J.A.H. da; Piermarini, G.J. Secretaria Estadual de Ciencia e Tecnologia, Rio de Janeiro, RJ (Brazil). 1989. (In Portuguese). (CONF-8908187–: 2. state meeting of new materials and 1. Florida-Brazil seminar on materials, Rio de Janeiro (Brazil), 2-4 Aug 1989). In *Advanced Ceramics.* Order Number DE90608004. Available from NTIS (US Sales Only), PC A16/MF A01 - OSTI; INIS.

A systematic study about the sintering of zirconia hyperfines powders in high-pressure is presented. The differents conditions effect of sintering in microstructure and in hardness and tenacity properties of zirconia samples with a very fine grain is also studied. (C.G.C.).

5498 (INIS-BR–1752, pp. 332-342) **Monocline - tetragonal transition of ZrO_2 in the ZrO_2-$Fe2O_3$ system.** Goldschmidt, R.H. (Paraiba Univ., Campina Grande (Brazil). Centro de Ciencias e Tecnologia); Kiminani, A. Secretaria Estadual de Ciencia e Tecnologia, Rio de Janeiro, RJ (Brazil). 1989. (In Portuguese). (CONF-8908187–: 2. state meeting of new materials and 1. Florida-Brazil seminar on materials, Rio de Janeiro (Brazil), 2-4 Aug 1989). In *Advanced Ceramics.* Order Number DE90608004. Available from NTIS (US Sales Only), PC A16/MF A01 - OSTI; INIS.

The effect of Fe_2O_3 on monocline-tetragonal transition of ZrO_2 was investigated by Differential Thermal (DTA) and X-ray Analyses. Small additions of Fe_2O_3 (1 mol %) increases the Hysteresis gap. Additions of 10 to 98 mol % of Fe_2O_3 increases the monocline tetragonal transition interval of ZrO_2 due to the Fe^{2+} and Fe^{3+} ions solubility in ZrO_2 matrix. (author).

5499 (INIS-BR–1752, pp. 343-354) **Microstructure and phase stability in YBa_2 Cu_3O_{7-x} doped with Nb_2O_5.** Assuncao, F.C.R. (Pontificia Univ. Catolica, Rio de Janeiro, RJ (Brazil). Dept. de Ciencia dos Materiais e Metalurgia); Lopes, M.F.S.; Carvalho, A.H.P.; Nunes, C.A.A. Secretaria Estadual de Ciencia e Tecnologia, Rio de Janeiro, RJ (Brazil). 1989. (In Portuguese). In *Advanced Ceramics.* Order Number DE90608004. Available from NTIS (US Sales Only), PC A16/MF A01 - OSTI; INIS.

The doping effect of 1-2-3 compound with Nb_2O_5 was investigated. Sampes of type $YBa_2(Cu_{1-y}Nby)_3O_{7-x}$, with y changing 0 to 0,08 were prepared from oxides and carbonates. The characterization of samples was made by scanning electron microscopy and X-ray diffraction, for the microstructure study and the phase identification. (C.G.C.).

5500 (INIS-BR–1753) **Synthesis, by alkaline fusion of zirconia from zirconite: characterization and preparation of lead zirconate-titanate.** Zaghete, M.A. Sao Carlos Univ., SP (Brazil). 1985. 156p. (In Portuguese). Order Number DE90608019. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Zirconium oxide was prepared from zirconite by alkaline fusion. The purity of zirconia was determined by atomic absorption spectroscopy and was found to be 99,94 wt%. In order to prepare en unglomerated and dry hidrous zirconia powder it was used alcohol and acetone for washing and gel suspension; control of the drying rate; and control of the atmosphere and temperature of the oven. The physical characteristics of the hidrous zirconia powder were determined after calcining in several conditions. The zirconia obtained by calcining at 800^{0}C during 5 hours (13,9m^2/g) was used with titanium oxide 7,6m^2/g and lead oxide (0,6m^2/g) to prepare a lead zirconate-titanate (PZT) with composition Pb $Zr_{0.5}Ti_{0.5}O_3$. Two different procedures were used to obtain high densits PZT pellets: in the first procedure the misture of the oxide powder with above composition were reacted at 850^{0}C for 4 hours. Then the powder was pressed and sintered at 1200^{0}C during 4 and 6 hours; in the second procedure the mixture of unreacted oxide were pressed in pellets and then reacted at 850^{0}C during 4 hours and sintered at 1200^{0}C during 4 and 6 hours. The apparent density of the sintered pellets were determined By mercury displacement and ranged from 7,25 to 7,39 g/cm^3 for the compacts obtained by the second procedure and from 8,08 to 8,10g/cm^3 for the compacts obtained by the first procedure. The microstructure observed by scanning electron microscopy showed that sintered compact obtained by the first procedure has a more homogeneous size distribution when compared with samples obtained be the second procedure. (author).

5501 (KFK–4628) **Electron microscopy of phase and microstructure development in aluminum silicate ceramics for the immobilization of transuranium element containing wastes.** Fieger, U. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Entsorgungstechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung; Technische Hochschule Darmstadt (Germany, F.R.). Aug 1989. 171p. (In German). Order

Number DE90729150. Available from NTIS (US Sales Only), PC A08/MF A01.

At the Institute for Nuclear Waste Technology (INE) with the Karlsruhe Nuclear Research Center (KfK) ceramic materials were evaluated as matrices for the solidification of radioactive alpha-bearing wastes. A suitable ceramic material, KAB 78, which is prepared from the raw materials kaolin, bentonite, and corundum, was examined with and without waste-simulating oxides. Applied methods were X-ray powder diffraction, scanning electron microscopy and transmission electron microscopy, both in combination with energy dispersive X-ray microanalysis. The effects of the sintering conditions and of the waste materials' nature are revealed and discussed. (orig.).

5502 (LA-UR–89-3841) **Laser mixing of titanium on silicon carbide.** Jervis, T.R.; Hirvonen, J.P.; Nastasi, M.; Cohen, M.R. Los Alamos National Lab., NM (USA). [1989]. 6p. Sponsored by U.S. Department of Defense; U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. DEW-88-24. (CONF-8911139–1: Conference on beam-solid interactions: physical phenomena, Boston, MA (USA), 27 Nov - 2 dec 1989). Order Number DE90003216. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We have used excimer laser surface processing to melt and mix single Ti layers into the surface of polycrystalline SiC substrates. The mixing of Ti into the surface is very rapid and efficient. Examination of Rutherford backscattering (RBS) data for different mixing conditions shows the formation of a preferred composition at the Ti-substrate interface which propagates from the interface with further mixing. Reconstruction of the RBS spectrum indicates that the composition of the layer is $Ti_{45}C_{37}Si_{18}$. X-ray diffraction demonstrates the formation of Ti silicides and carbides in the surface region. Profiling of C in both mixed and uncoated samples by 5 MeV He^+ scattering demonstrates that laser processing of the SiC does not cause major changes in the stoichiometry of the substrate material. 6 refs., 3 figs., 1 tab.

5503 (LA-UR–89-3963) **Partial reduction of re-oxidation processing of Y-Ba-Cu-O sputtered thin films.** Garzon, F.H.; Beery, J.G.; Wilde, D.K.; Raistrick, I.D. Los Alamos National Lab., NM (USA). [1989]. 9p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-36. (CONF-891119–11: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989). Order Number DE90003655. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Thin films of Y–Ba–Cu–O were produced by rf sputtering of $YBa_2Cu_3O_{7-x}$ ceramic targets, using a variety of plasma compositions, rf power levels, and substrate temperatures. Post annealing of these films in oxygen produced superconducting films with T_c values between 40–60 K, broad transition widths and semiconductor-like electrical behavior above T_c. Subsequent annealing at 850°C in an inert gas with a residual oxygen partial pressure of $\leq$10 ppM followed by an oxygen anneal produced high quality thin films: $T_c >$ 85 K with narrow transition widths. The structure and morphology of these films during reduction-oxidation processing were monitored using x-ray diffraction and electron microscopy. 8 refs., 4 figs.

5504 (LA-UR–89-4010) **The influence of the substrate surface on the nucleation and growth of superconducting thin films.** Basu, S.N.; Bordes, N.; Rollett, A.D.; Cohen, M.R.; Nastasi, M. Los Alamos National Lab., NM (USA). 1989. 5p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-891119–14: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989). Order Number DE90003649. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The quality of epitaxially grown superconducting thin films is dependent on the nature of the substrate surface. In this study, the surface of <100> oriented $SrTiO_3$ single crystals was modified by mechanical polishing, thermal annealing and chemical etching. A study of the $YBa_2Cu_3O_{7-x}$ thin films grown on these substrates showed that high quality superconducting films were obtained when the substrate surface was highly oriented in the <100> direction and was also microscopically smooth. 7 refs., 3 figs., 1 tab.

5505 (PB–89-234553/XAB) **New Tl-Ba-Ca-Cu-O (1234 and 1245) superconductors with T_c >117k.** Ihara, H.; Hirabayashi, M.; Terada, N.; Jo, M.; Hayashi, K. Electrotechnical Lab., Tsukuba, Ibaraki (Japan). 1989. 12p. Available from NTIS, PC E10/MF A01.

Text in Japanese; Included in Bulletin of the Electrotechnical Laboratory, Vol. 53, No. 2 57-68(1989).

The new $TlBa_2Ca_3Cu_4O_{11}$ (1234) and $TlBa_2Ca_4Cu_5O_{13}$ (1245) superconductors with new composition and new structure were designed and synthesized for the first time. The compounds have the T_c values of about 117 to 122 K. The highest Tc value was obtained for the 1234 phase. These are single Tl-O layer compounds with less Tl content than a half of that in the previous 2223 phase. The structure of the compounds is a simple tetragonal phase with the lattice constants of a=b=3.85 A and c=19.1A for the 1234 phase and a=b=3.85A and c=22.3A for the 1245 phase. The electron-diffraction patterns and the lattice images from a high-resolution TEM have confirmed the oxygen-deficient layered-perovskite structure with the space group of P4/mmm. The c-lattice constant follows the c-axis rule of a linear relation of c=6.3+3.2n (n=the number of Cu-O layer). The T_c value is strongly related to the valence of Cu ion.

5506 (SAND–89-1723C) **Superconductivity and stoichiometry in $Tl_2Ca_2Ba_2Cu_3O_x$ single crystals.** Venturini, E.L.; Tigges, C.P.; Baughman, R.J.; Ginley, D.S.; Morosin, B. Sandia National Labs., Albuquerque, NM (USA). [1989]. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-891119–33: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989). Order Number DE90003838. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Magnetization and resistivity data are presented which show a substantial difference in superconducting transitions for nominal $Tl_2Ca_2Ba_2Cu_3O_x$ plates with identical crystal structures grown from two different "melt" compositions. A CuO-rich starting composition yielded approximately stoichiometric plates which have sharp transitions beginning near 111 K, while a second composition with less CuO produced plates containing more Tl and less Ba with very broad transitions starting near 96 K. These data demonstrate the extreme sensitivity of superconductivity to cation site disorder in the Tl-Ca-Ba-Cu-O system.

5507 (SAND–89-1727C) **Ion-irradiation effects in $Tl_2Ca_2Ba_2Cu_3O_{10}$ superconductors.** Barbour, J.C.; Kwak, J.F.; Venturini, E.L.; Ginley, D.S.; Peercy, P.S. Sandia National Labs., Albuquerque, NM (USA). [1989]. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-891119–32: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989). Order Number DE90003840. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The effects of oxygen and helium ion irradiation on the superconducting properties of $Tl_2Ca_2Ba_2Cu_3O_{10}$ thin films were investigated. The transition temperature and width were monitored as a function of ion fluence using both magnetization and resistivity measurements. These data suggest that superconductivity is completely suppressed at 0.020 dpa for both He and O ion irradiation. Further, the rate of decrease in $T_c$as a function of deposited energy showed that the dominant mechanism causing damage-induced suppression of $T_c$in these films was from atomic collisions. 7 refs., 3 figs.

5508 (SAND–89-2793C) **Cation disordering in the Tl-2122 superconductors.** Morosin, B.; Ginley, D.S.; Venturini, E.L.; Baughman, R.J.; Schirber, J.E.; Tigges, C.P. Sandia National Labs., Albuquerque, NM (USA). [1989]. 8p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-891119–22: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989). Order Number DE90003579. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We have examined several crystals belonging to the Tl-2122 structure type ($Tl_2CaBa_2Cu_2O_8$ with c = 29Å), and have shown that cation solid solution occurs. Such cation disorder appears to be responsible for the observed small differences in lattice parameters reported by various investigators and to contribute towards the substantial variation in the superconducting transition temperatures. 10 refs., 2 tabs.

5509 (UzIYaF-R–2-285) **Features of short-range order structure in interstitial alloys on the base of transition metals.**

Khvatinskaya, D.Ya.; Karimov, I.Ya.; Presman, V.S. AN Uzbekskoj SSR, Tashkent (USSR). Inst. Yadernoj Fiziki. 1987. 11p. (In Russian). Order Number DE90610769. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

R-17009.

It was studed the short-range ordering in TiN_x, $ZrC_{0.74}$, $NbC_{0.8}$ after quenching from high temperature was studed by neutron diffraction. It was determined the value of the short-range order parameters, the pair interaction potentials of nitrogen and carbon atoms in some neighbours. It was calculated the Fourier-components of pair interaction potentials in some simmetric directions in reciprocal lattice. 9 refs.; 2 figs.

3606 Other Materials

Refer also to citation(s) 4559, 4753, 4780, 4911, 4931, 5228, 5289, 5349, 5420, 5453, 5454, 5461, 5469, 5564, 5670, 5704, 5751, 5787, 6236, 6237, 6357

5510 (CONF-891124–1) **Molecular dynamics study of the structure and dynamics of network glasses.** Vashishta, P. (Argonne National Lab., IL (USA)); Kalia, R.K.; Antonio, G.A.; Rino, J.P.; Iyetomi, H.; Ebbsjoe, I. Argonne National Lab., IL (USA). Oct 1989. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 7. international conference on solid-state ionics; Hakone (Japan); 5-9 Nov 1989. Order Number DE90003782. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Structure and dynamics of binary SiO_2, $GeSe_2$ and $SiSe_2$, and ternary Ag/Ge/Se chalcogenide glasses are studied using the molecular dynamics (MD) method. Effective potentials consisting of two-body (steric repulsion, Coulomb interactions due to charge transfer, and charge-dipole interaction due to large electronic polarizability of anions) and three-body covalent interactions are proposed for chalcogenide glasses. Using these, MD simulations are performed to study short range order, intermediate range order manifested as the first sharp diffraction peak (FSDP), the vibrational density of states, and the participation ratios. MD results are compared with x-ray and neutron experiments. 14 refs., 6 figs.

5511 (DOE/ER/13949–T1) **Thin films under chemical stress: Progress report, July 1–July 31, 1989.** Illinois Univ., Urbana, IL (USA). 1989. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER13949. Order Number DE90003754. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

As stated above the purpose of this research is to enable workers in a variety of fields to understand the chemical and physical changes which take place when thin films (primarily organic films) are placed under chemical stress. This stress may occur because the film is being swelled by a penetrant entrained in solvent, because interfacial reactions are occurring at one or more boundaries within the film structure, or because some component of the film is responding to an external stimulus (e.g., pH, temperature, electric field, or radiation). The efforts build upon the optical depth profiling (ODP) capability developed in our laboratory, using these techniques as starting points for the description of film behavior under chemical stress. In the past year we have concentrated on the following objectives: (1) development of experimental protocols for probing the film-liquid system in real time, (2) understanding the diffusion behavior of a model systems containing all the complications likely to be present in more general systems. Progress in meeting each of these objectives will be described separately below.

5512 (DOE/ER/45237–T1) **Phase transition in polymer blends and structure of ionomers: Performance report, April 1, 1989–October 25, 1989.** Chu, B. State Univ. of New York, Stony Brook, NY (USA). Dept. of Chemistry. [1989]. 24p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER45237. Order Number DE90003525. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Progress is briefly reported on small angle x-ray scattering measurements (SAXS) of the following: solutions of polystyrene-polyisoprene AB block copolymer in aniline; gelatin; sulfonated polystyrene ionomers; and lead sulfides. 20 figs., 1 tab. (CBS)

5513 (ENEA-RT-TIB–88-47) **Ionic molecular films. Applications : I-structural phase transition in new materials for acousto-optical use.** Montereali, R.M.; Scavarda do Carmo,L.C. ENEA, Casaccia (Italy). Dipt. Tecnologie Intersettorialli di Base. May 1989. 11p. Order Number DE90724605. Available from NTIS (US Sales Only), PC A03/MF A01.

Integrated optics if a far-reaching attempt to apply thin film technology to optical circuits and devices, by miniaturization of the needed optical components with concomitant improvement in efficiency and ruggedness. Lenses, prisms and gratings can be built by changing the thickness or the dielectric constant on thin films. Moreover, since the films have a thickness comparable to the optical wavelength and since most of the light energy is confined within the film, the power density (and consequently the non-linear effects) inside the film can be very large even at moderate exitation power level. Analogously high electric fields per unit length can be obtained with low voltage, allowing light modulation and deflection, by the use of electro-optic material either for film of for film and substrate or for multilayer film. This report discusses some elastic and optical properties of simple ternary alkali-like (CKI type) materials, such as NaCN, KCN and RbCN. At a given critical temperature (288 K for NaCN, 168 K for KCN and 130 K for RbCN), they present a order <-> disorder type structural phase transition and, in the vicinity of that temperature, abnormally small stiffness coefficients. The recently demonstrated ability to evaporate thin films of KCN with the same structural properties of bulk crystals makes that class attractive in the field of low stress induced surface acoustical waves (SAW).

5514 (INIS-BR–1692, pp. 209-217) **Computational methods for comparing the materials used as filters, in radiodiagnostic.** Brochl, M.A.C. (Sao Paulo Univ., Ribeirao Preto, SP (Brazil). Faculdade de Filosofia, Ciencias e Letras); Ghilardi Netto, T.; Jennings, R.J. Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. (In Portuguese). (CONF-8908184–: 3. meeting of the Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). In *Proceedings of the 3. Brazilian Congress of Physicists in Medicine*. Order Number DE90705978. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

A comparison method of materials based in the adjustments of its spectra is presented. (author).

5515 (Juel–2284) **Kinetics of the graphite/oxygen reaction in the in-pore diffusion controlled regime. Pt. 3. Influence of boundary layer diffusion in kinetic experiments at temperatures 970 K - 1170 K.** Hinssen, H.K.; Moormann, R. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Sicherheitsforschung. Jun 1989. 36p. (In German). Available from Available from Kernforschungsanlage Juelich GmbH (Germany, F.R.). Zentralbibliothek.

A reevalution of experimental data for the kinetics of the reaction between oxygen and nuclear graphites at temperatures 970 K - 1170 K is presented. This reevalution mainly covers an improved handling of the influence of boundary layer diffusion (mass transfer) on the measured rates. It is demonstrated, that a remarkable influence of boundary layer diffusion exists down to rather low temperatures. Rates for the in-pore diffusion controlled regime, which have been presented earlier, are therefore corrected to higher values which increase with increasing temperature. The maximum correction factor is 1.6. (orig.).

5516 (LAFI–142) **Radiation- and photoinduced processes in glass-like arsenic trisulfide and triselenide.** Matkovskij. A.O.; Shvarts, K.K.; Pirogov, F.V.; Shpotyuk, O.I.; Savitskij, I.V. AN Latvijskoj SSR, Riga (USSR). Inst. Fiziki. 1988. 42p. (In Russian). Order Number DE90609781. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Peculiarities of photo-structural transformations and results of gamma- and electron-radiation effect upon microhardness, optical absorption, IK and EPR spectra have been studied for glassy chalcogenide semiconductors (GCS). It has been shown that high-energy-radiation-induced changes in the GCS physical properties depend on radiation parameters, thermal conditions and the composition of the sample. Mechanisms of radiation-induced transformations (RIC) for glassy arsenic trisulfide and triselenide are discussed. The RIC is supposed to have been predetermined by the

following correlated processes: destruction-polymerization, radiation defect formation, and impurity radiolysis. 77 refs.; 10 figs.; 2 tabs.

5517 (LA-UR–89-2430) **Numerical simulation of wave propagation through cemented granular material.** Trent, B.C. (Los Alamos National Lab., NM (USA)). Los Alamos National Lab., NM (USA). [1989]. 29p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-891208–11: Winter annual meeting of the American Society of Mechanical Engineers, San Francisco, CA (USA), 10-15 Dec 1989). Order Number DE89015251. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The distinct element method (DEM) has been used to model wave propagation through a matrix material composed of circular particles which are glued together with elastic bonds. Wave propagation through the sample is shown to be governed by the properties and distribution of individual bonds. 4 refs., 12 figs.

5518 (LA-UR–89-3546) **Damage to Macor glass-ceramic from high-dose 14 MeV neutrons.** Coghlan, W.A. (Grand Canyon Univ., Phoenix, AZ (USA). Dept. of Physics); Clinard, F.W. Jr. Los Alamos National Lab., NM (USA). [1989]. 16p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-891204–1: 4. international conference on fusion reactor materials, Kyoto (Japan), 4-8 Dec 1989). Order Number DE90002416. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Macor machinable glass-ceramic was irradiated to fluences up to 1×10^{23} 14 MeV n/m^2 at room temperature. Post-irradiation measurements were carried out to determine changes in high-frequency electrical conductivity, hardness, and density. It was found that neutron damage caused slight increases in conductivity and hardness. The major changes noted was in density, where a fluence of 4×10^{22} n/m^2 caused swelling of 1.55 vol % while a dose of 1×10^{23} n/m^2 resulted in a lower swelling value (0.82 vol %). This unusual behavior is explained by a model involving expansion of the mica phase of Macor and contraction of the glassy phase. Implications of the present results for engineering performance of Macor at these and higher fluences are discussed. 11 refs., 5 figs.

5519 (LA-UR–89-3940) **The physical properties of microcellular composite foams.** Nyitray, A.M. (Los Alamos National Lab., NM (USA)); Williams, J.M.; Onn, D.; Witek, A. Los Alamos National Lab., NM (USA). [1989]. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-891119–12: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989). Order Number DE90003658. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Recently we reported on a method of preparing microcellular composite foams. In this procedure an open-celled polystyrene foam is prepared by the polymerization of a high-internal-phase water-in-oil emulsion containing styrene, divinylbenzene, surfactant, free-radial initiator and water. After drying, the cells of the polystyrene foam are then filled with other materials such as aerogel or resoles. The physical properties of these materials, e.g., surface area, density, thermal conductivity, and compressive strength will be presented. 10 refs., 1 fig., 3 tabs.

5520 (NAE–30057) **Processing of advanced ceramics which have potential for use in gas turbine aero engines.** Maccagno, T.M. (National Aeronautical Establishment, Ottawa, ON (Canada)). National Aeronautical Establishment, Ottawa, ON (Canada). 1989. 42p. (MICROLOG–89-03535). Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Si_3N_4 and SiC based advanced ceramics that have been produced by hot isostatic pressing (HIP'ing) have good potential to be used as hot section components in gas turbine aero engines. This report provides background for an investigation of this potential. The report begins with a general overview of the many fabrication methods that have been used to produce both monolithic ceramics and SiC whisker reinforced composite ceramics. This is followed by a comprehensive survey of past efforts to produce Si_3N_4 and SiC based ceramics by HIP'ing of material that has already been densified by sintering, but such an approach does not really allow the full benefits of HIP processing to be realized. On the other hand, HIP'ing of Si_3N_4 based composite produced by reaction bonding may result in ceramic material of superior quality. It also appears that many previous efforts have resorted to incorporating densifying aids into the starting material, even though high temperature properties may suffer as a result. It is sugggested that HIP'ing of vacuum encapsulated Si_3N_4 or SiC particulate that contains SiC whiskers for reinforcement, but which does not contain densifying aids, may be a method of producing ceramic material of sufficient quality to be considered for use in gas turbine engines. 55 refs., 3 figs., 3 tabs.

5521 (PNL-SA–17327) **Optical properties and laser damage measurements of inorganic polymer films.** Exarhos, G.J.; Crosby, K.M. Pacific Northwest Lab., Richland, WA (USA). Nov 1989. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-891163–1: 21. annual symposium on optical materials for high power lasers, Boulder, CO (USA), 1-3 Nov 1989). Order Number DE90003633. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Linear phosphorus-nitrogen bases polymers have been synthesized and deposited as thin films from solution on silica or silicon substrates using dip-coating or spin-casting methods. Most materials transmit well into the ultraviolet region of the spectrum and have refractive indices (1.5 to 1.7 at 500 nm) which are controlled by the functionality of chemical substituents introduced at the phosphorus atom. Films exposed to pulsed laser irradiation (1064 nm, 8ns pulsewidth) exhibit damage morphologies ranging from severe cratering to delamination. The chloro-substituted polymer shows a spheroidal surface morphology after exposure to a 25 J/cm^2 pulse suggesting melting or condensation of ablated material. The relative stability of these materials to laser irradiation will be discussed in terms of chemical bond ionicity which is influenced by atom electronegativity and the nature of substituent groups. Preliminary measurements of the non-linear optical response observed in several of these materials (SHG) will also be discussed.

5522 (PNL-SA–17607) **Ceramic processing using inorganic polymers.** Lannutti, J.J. (Washington Univ., Seattle, WA (USA). Dept. of Materials Science and Engineering); Aksay, I.A.; Schilling, C.H. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC06-76RL01830. (CONF-890426–31: Spring meeting of the Materials Research Society, San Diego, CA (USA), 24-28 Apr 1989). Order Number DE90003638. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Inorganic polymers are used in the formation of green compacts via sedimentation of colloidal alumina suspended in chloroform. Polymers containing highly polar components tend to produce constant density profiles of greater than 55 percent density, while those containing nonpolar, reactive components produce profiles with a large gradient in packing density. Density profiles describing the sedimentation behavior versus time and the final dried density of the compacts are generated via the use of gamma-ray densitometry. These polymers have the potential not only to increase green compact density but also to reduce "burnout" and subsequent sintering requirements by pyrolyzing to useful ceramic. 16 refs., 9 figs.

5523 (SAND–89-0685C) **The role of pressure in the study of organic superconductors.** Schirber, J.E. (Sandia National Labs., Albuquerque, NM (USA)); Williams, J.M.; Wang, Hau H. Sandia National Labs., Albuquerque, NM (USA); Argonne National Lab., IL (USA). [1989]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC04-76DP00789;W-31109-ENG-38. (CONF-891206–3: International chemical congress of Pacific Basin Society symposium on polymer rheology and processing (PACIFICHEM '89), Honolulu, HI (USA), 17-22 Dec 1989). Order Number DE90002908. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The impact of high pressure in the study of organic superconductivity is reviewed. Studies of the pressure dependence of the superconducting transition temperature of the $(ET)_nX_m$ family using solid He pressure techniques and high quality single crystal samples are discussed in detail. 28 refs., 2 figs.

5524 (SAND–89-1607C) **New devices using ferroelectric thin films.** Land, C.E.; Butler, M.A.; Martin, S.J. Sandia National Labs., Albuquerque, NM (USA). [1989]. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-891205–1: IEEE international electron devices meeting, Washington, DC (USA), 3-6 Dec 1989). Order Number DE90000789. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Recent developments in the fabrication technologies of ferroelectric thin films in general and of PZT (lead zirconate titanate) and PLZT (lead lanthanum zirconate titanate) thin films in particular have suggested the feasibility of several new devices. Integrated optical devices for information processing and high-speed switching, high-density optical information processing and storage devices and spatial light modulators are some of the applications currently being investigated for these films. Ongoing studies of the longitudinal electrooptic effects and the photosensitivities of PZT and PLZT thin films have established the feasibility of erasable/rewritable optical memories with fast switching and potentially long lifetimes compared to current magneto-optic thin film devices. Some properties of PZT thin films and of new devices based on those properties are described in this paper. 15 refs., 5 figs., 1 tab.

5525 (SAND–89-1653C) **Band-to-band transitions in poly (phenyl methyl silane).** Kepler, R.G.; Zeigler, J.M. Sandia National Labs., Albuquerque, NM (USA). 1989. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-891119–21: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989). Order Number DE90003575. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We have measured the quantum efficiency for carrier generation as a function of photon energy and the electroabsorption spectrum in poly (phenyl methyl silane). The experimental data are consistent with a band gap of about 4.6 eV. A strong absorption peak which is observed at 3.7 eV is an exciton band. 9 refs., 4 figs.

5526 (SAND–89-1820C) **The elastic properties of woven polymeric fabric.** Warren, W.E. (Sandia National Labs., Albuquerque, NM (USA)). Sandia National Labs., Albuquerque, NM (USA). [1989]. 20p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-891230–1: Symposium on mechanics of plastics and plastic composites, San Francisco, CA (USA), 10-15 Dec 1989). Order Number DE89015391. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The in-plane linear elastic constants of woven fabric are determined in terms of the specific fabric microstructure. The fabric is assumed to be a spatially periodic interlaced network of orthogonal yarns and the individual yarns are modeled as extensible elastica. These results indicate that a significant coupling of bending and stretching effects occurs during deformation. Results of this theoretical analysis compare favorable with measured in-plane elastic constants for Vincel yarn fabrics. 17 refs., 2 figs., 1 tab.

5527 (SAND–89-2767C) **Characterization and in situ testing of diamond films.** Peebles, D.E.; Pope, L.E. Sandia National Labs., Albuquerque, NM (USA). [1989]. 19p. Sponsored by U.S. Department of Defense; U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. FY1457-89-5004. (CONF-8911129–2: Air Force tribology technical review, Fairborn, OH (USA), 27-30 Nov 1989). Order Number DE90003155. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Diamond films deposited on silicon wafers have been evaluated by a variety of analytical and mechanical procedures in preparation for tribological studies of these films. For in situ wear studies of diamond films, analysis techniques must be developed that do not damage the films. An ion sputter-cleaning procedure has been found (200 eV acceleration energy) which allows reduction of surface contaminants and a "cleaning up" of the sp^3 bonding. Preliminary tribological pin-on-plate studies have been completed for a hardened 440C stainless steel pin sliding on the diamond films in laboratory air.

5528 (UCRL–98598) **Spectral filters based on ethylene/acrylic acid copolymer ionomers.** Riley, M.O.; Walkup, C.M.; Hagen, W.F.; Jessop, E.S. Lawrence Livermore National Lab., CA (USA). Sep 1988. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-880912–33: 196. American Chemical Society national meeting, Los Angeles, CA (USA), 25-30 Sep 1988). Order Number DE90002991. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We are investigating the possibility of utilizing ionomers as inexpensive, easily replaced optical filters for applications in large fusion lasers as well as high average power solid state lasers. To this end we have synthesized a number of other derivatives of the ethylene/acrylic acid (EAA) copolymer system. Specifically, we prepared several ionomers at nominal 3 wt. % metal ion concentration, including Fe(III), Co(II), Ni(II), Cu(II), and Ce(III), by reacting aqueous solutions of metal acetates or nitrates with aqueous ammonia dispersions (1) of EAA as described previously. The products were compression molded into thin optically clear films under the above-described conditions. A gel was formed in a similar reaction with samarium (III) nitrate. Accordingly, the samarium ionomer was synthesized by a melt phase reaction between the EAA resin and the metal nitrate. 6 refs., 2 figs., 2 tabs.

5529 (UCRL–101380) **Mechanical structure-property relationships of inorganic and organic aerogels.** LeMay, J.D. (Lawrence Livermore National Lab., CA (USA)); Pekala, R.W.; Hrubesh, L.W. Lawrence Livermore National Lab., CA (USA). 6 Jul 1989. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-891242–1: 1. Pacific polymer conference, Maui, HI (USA), 12-15 Dec 1989). Order Number DE89017533. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report briefly covers Lawrence Livermore National Laboratory's research and development into aerogels. 7 refs. (JDL)

5530 (UCRL–101381) **Composite activities at Lawrence Livermore National Laboratory.** Groves, S.E. Lawrence Livermore National Lab., CA (USA). Jul 1989. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8907167–1: Joint Operations Weapons Operations Group conference, Aldermaston (UK), 11 Jul 1989). Order Number DE90002979. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

At LLNL we have a broad and integrated effort underway to study the behavior of composite materials. We are actively generating material properties for a variety of high performance fibers and resins for use in filament wound structures. We have research programs investigating the three-dimensional failure behavior of these systems, general property evaluations, as well as investigations of the individual behavior of the fibers and resins. We are also investigating the high strain rate properties of some of these materials. We have a complete facility which includes a six-axis filament winding machine, a biaxial test machine for performing tension, torsion, and internal pressurization of composite tubes, 3-D compression fixtures, external ring compression fixtures, rheometer, FTIR, and many other specialized testing fixtures. The focus of this paper will be on the characterization of the three-dimensional failure behavior of the continuous fiber composites utilized at LLNL.

5531 (UCRL–101602) **Bonding aerogels with polyurethanes.** Matthews, F.M.; Hoffman, D.M. Lawrence Livermore National Lab., CA (USA). 1 Nov 1989. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8905241–1: Society of Plastics Engineers annual technical conference, Dallas, TX (USA), 7-11 May 1989). Order Number DE90003050. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Aerogels, porous silica glasses with ultra-fine cell size (30nm), are made by a solution gelation (sol-gel) process. The resulting gel is critical point dried to densities from 0.15–0.60 g/cc. This material is machinable, homogeneous, transparent, coatable and bondable. To bond aerogel an adhesive should have long cure time, no attack on the aerogel structure, and high strength. Several epoxies and urethanes were examined to determine if they satisfied these conditions. Bond strengths above 13 psi were found with double bubble and DP-110 epoxies and XI-208/ODA-1000 and Castall U-2630 urethanes. Hardman "Kalex Tough Stuff" A-85 hardness urethane gave 18 psi bond strength. Hardman A-85, "Tuff-Stuff" was selected for further evaluation because it produced bond strengths comparable to the adherend cohesive strength. 5 refs., 2 figs.

5532 (UCRL–101623) **Statistical model for particle-void deformation kinetics in granular materials during shock wave propagation.** Stout, R.B. Lawrence Livermore National Lab., CA (USA). 25 Jul 1989. 24p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-48. (CONF-891241–1: International symposium on wave propagation in granular media, San Francisco, CA (USA), 10-14 Dec 1989). Order Number DE89017729. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The object of this article is a physically based theory for the shock response of granular materials. The approach applied concepts from classical statistical mechanics to represent physical attributes and their time rates of change that are descriptive of particle-void kinetics in deforming granular materials. Mathematically, an arbitrary volume in a granular material is viewed as a set of particles and a set of void spaces. A statistical description for the set of particles is defined in the context of physical attributes that characterize a given species of particle. Similarly, a statistical description for the set of void spaces is defined in the context of physical attributes that characterize a given species of void. For a statistical formulation that describes deformation kinematics across a propagating shock front, field expressions for the relative deformation and its associated kinematic measures are represented with functionals that depend on the probability density functions for the sets of particles and voids. In deriving field equations for the shock analysis, a thermodynamic model for particle-void kinetics was developed. As part of this development, a thermodynamic potential for the particle-void kinetics was defined. 22 refs.

5533 **Radiation effects on gallium arsenide integrated optical devices.** McWright, G. (Lawrence Livermore National Lab., PO Box 808, Livermore, CA (US)); Lowry, M.; Roeske, F.; Takeuchi, E.; Tindall, W.; Murphy, G. pp. 380 of Optoelectronic materials, devices, packaging, and interconnects. Batchman, T.E.; Carson, R.F.; Gallawa, R.L.; Wojtunik, H.J SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1987). DOE Contract W-7405-ENG-48. (CONF-8708229–: Optoelectronic materials, devices, packaging, and interconnects, San Diego, CA (USA), 19-21 Aug 1987).

The authors discuss gallium arsenide integrated optical devices for high speed diagnostic systems. They focus on the effect of radiation exposure on the performance characteristics of these devices.

5534 **Ultrafast photoconductor radiation detectors.** Wang, C.L. (Lawrence Livermore National Lab., PO Box 808, Livermore, CA (US)); Pocha, M.D.; Morse, J.D.; Singh, M.S.; Davis, B.A. pp. 380 of Optoelectronic materials, devices, packaging, and interconnects. Batchman, T.E.; Carson, R.F.; Gallawa, R.L.; Wojtunik, H.J SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1987). DOE Contract W-7405-ENG-48. (CONF-8708229–: Optoelectronic materials, devices, packaging, and interconnects, San Diego, CA (USA), 19-21 Aug 1987).

The authors are developing and investigating homogeneous, photoconductive semiconductors as very fast radiation detectors. They irradiated GaAs, Cr-doped GaAs, and Fe-doped InP crystals with 14-MeV neutrons to produce lattice defects that act as fast-recombination centers for electrons and holes. Using short-pulse lasers and 17-MeV linear-accelerator electrons and bremsstrahlung x rays and γ rays, they have measured the temporal response and sensitivity of these photoconductors as functions of fluence ranging from 10^{12} to 10^{16} neutrons/cm^2. The carrier lifetime and mobility decrease monotonically as the neutron fluence increases, resulting in faster detector response at the expense of sensitivity. A resolving time of less than 30 ps (FWHM) was measured for the above photoconductors irradiated with $\rightarrow 10^{15}$ neutrons/cm^2.

5535 **Initial stages of silicon growth on the (100) surface of silicon by localized laser CVD.** Kotecki, D.E. (Lawrence Livermore National Lab., CA (USA). Physics Dept.). pp. 509 of Laser and particle-beam chemical processing for microelectronics. Ehrlich, D.J.; Higashi, G.S.; Oprysko, M.M. Materials Research Society, Pittsburgh, PA (1988). DOE Contract W-7405-ENG-48. (CONF-8711147–: Laser and particle-beam chemical processing for microelectronics, Boston, MA (USA), 30 Nov - 3 dec 1987).

This paper reports initial results of an experimental study of the early stages of silicon thin film growth on well prepared (100) c-Si surfaces by pyrolytic deposition from silane (SiH_4) during localized laser chemical vapor deposition (LLCVD). The rate of silicon thin film growth during low pressure (<10 Torr) deposition using tightly focussed laser beams (514.5 nm, ~2.5 μm FWHM) is characterized and is shown to be much slower than expected based on the previously measured silane decomposition rate. Hybrid-heating experiments, in which laser heating induces a slight temperature increase on a uniformly heated substrate in the presence of silane gas, shows that growth is inhibited within the laser irradiation region. This result suggests that a nonpyrolytic mechanism contributes to silicon growth in laser CVD. Possible explanations for this nonpyrolytic growth mechanism are discussed.

5536 **An analysis of the effect of system variables on the quality of thin films and powders produced by laser-breakdown chemical vapor deposition.** Joyce, E.L. Jr. (Los Alamos National Lab., NM (USA). Materials Science and Technology Div.); Jervis, T.R. pp. 509 of Laser and particle-beam chemical processing for microelectronics. Ehrlich, D.J.; Higashi, G.S.; Oprysko, M.M. Materials Research Society, Pittsburgh, PA (1988). DOE Contract W-7405-ENG-36. (CONF-8711147–: Laser and particle-beam chemical processing for microelectronics, Boston, MA (USA), 30 Nov - 3 dec 1987).

A gas phase process for large area depositions on an ambient temperature substrate using laser-induced dielectric breakdown of gas phase precursors has recently been developed. Deposits of nickel alloys show excellent grain refinement (<10 nm) and metastable phase incorporation due to rapid quenching from the gas phase. Particle size distribution and compositional variance within the deposited films have been studied using electron microscopy and electron diffraction. Kinetic expressions to explain homogeneous gas phase nucleation and growth of the deposited materials have been developed in an effort to better understand this process. The effect of system variables on film and powder grain sizes has been studied. This analysis gives insight into the fluid flow/heat transfer patterns involved in the system and their effect on the final deposited material. The effect of system pressure, gas phase composition, and laser pulse energy, on particle size, surface area coverage, and deposition thickness are discussed.

5537 **Fabrication and evaluation of transmissive multilayer optics for 8 keV x rays.** Bionta, R.M. (Lawrence Berkeley Lab., CA (USA)); Jankowski, A.F.; Makowiecki, D.M. pp. 365 of Multilayers: Synthesis, properties and non-electric applications. Barbee, T.W. Jr.; Spaepen, F.; Greer, L. Materials Research Society, Pittsburgh, PA (1988). DOE Contract W-7405-ENG-48. (CONF-8711143–: Symposium on multilayers: synthesis, properties and nonelectronic applications, Boston, MA (USA), 30 Nov - 4 dec 1987).

The authors have made and tested several sliced multilayer structures which can function as transmissive x-ray optical elements (diffraction gratings, zone plates, and phase gratings) at 8 keV. Their automated multilayer sputtering system is optimized to sputter layers of arbitrary thickness for very large total deposits at high deposition rates. Diffraction patterns produced by the multilayer devices closely match theoretical predictions. Such transmissive optics have the potential for wide application in high resolution microscope and spectrometer systems.

5538 **The effect of interfacial disorder on the x-ray diffraction of superlattices.** Locquet, J.P. (Lab. for Vaste Stof-Fysika en Magnetisme, Katholieke Univ. Leuven, B-3030, Leuven (BE)); Neerinck, D.; Sevenhans, W.; Bruynseraede, Y.; Homma, H.; Schuller, I.K. pp. 365 of Multilayers: Synthesis, properties and non-electric applications. Barbee, T.W. Jr.; Spaepen, F.; Greer, L. Materials Research Society, Pittsburgh, PA (1988). (CONF-8711143–: Symposium on multilayers: synthesis, properties and nonelectronic applications, Boston, MA (USA), 30 Nov - 4 dec 1987).

The authors have generalized their x-ray diffraction results from amorphous/crystalline multilayers, to include random interfacial disorder of a gaussian type. A general relation is obtained which can be applied to both crystalline/crystalline and crystalline/amorphous multilayers. This gaussian fluctuation or roughness can strongly reduce the long-range atomic order along the growth direction of the multilayer. Using classical structure factor calculations, they simulate the evolution of x-ray patterns as a function of the fluctuation

amplitude, the superlattice wavelength, and the interatomic distances. Applying this model to the crystalline/crystalline case they fit the experimental Nb/Cu data, deduce a fluctuation amplitude of about 0.4 A, and relate it to the lattice mismatch between Nb and Cu. For crystalline/amorphous systems (Pb/Ge) this amplitude can be significantly larger (2 A).

5539 **Photolytic deposition of InSb films.** Zuhoski, S.P. (Sandia National Labs., Albuquerque, NM (USA)); Killeen, K.P.; Biefeld, R.M. pp. 509 of Laser and particle-beam chemical processing for microelectronics. Ehrlich, D.J.; Higashi, G.S.; Oprysko, M.M. Materials Research Society, Pittsburgh, PA (1988). DOE Contract AC04-76DP00789. (CONF-8711147–: Laser and particle-beam chemical processing for microelectronics, Boston, MA (USA), 30 Nov - 3 dec 1987).

Films of InSb were deposited on GaAs <100> substrates at room temperature by excimer laser photolysis at 193 or 248 nm of a mixture of trimethylindium (TMIn) and trimethylantimony (TMSb) in a hydrogen carrier medium. These films were compared to thermally grown MOCVD InSb films by optical microscopy and x-ray analysis and found to be stoichiometric polycrystalline, InSb. In situ UV absorption spectroscopy has been used for the first time on an MOCVD system to monitor and control the partial pressures of the metalorganic reactants during deposition. This latter diagnostic was found to be critically important since parasitic reactions cause depletion of TMIn during transport from the source bubbler to the growth chamber.

40 CHEMISTRY

Refer also to citation(s) 5403, 6469

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5540 (AD-A–211694/5/XAB) **SANS (Small Angle Neutron Scattering) of catalyst on the growth process of silica gels.** Winter, R.; Hua, D.; Thiyagarajan, P.; Jonas, J. Illinois Univ., Urbana, IL (USA). Dept. of Chemistry. 1989. 7p. Available from NTIS, PC A02/MF A01.

Pub. in Jnl. of Non-Crystalline Solids, Vol. 108, 137-142(1989).

The sol-gel process for preparing oxide glasses has attracted widespread attention in the last few years because it allows the preparation of glasses with very high homogeneity and the fabrication of glasses with special chemical composition; besides, processing can be performed at relatively low temperatures. It has been shown that the fluoride anion F^- is one of the most effective catalysts in accelerating the gelation process. Small angle neutron scattering (SANS) experiments have been employed to investigate the structural evolution of uncatalyzed and fluoride catalyzed tetramethoxysilicate $Si(OCH_3)_4/CH_3OH/H_2O$ solutions from the sol to the gel state. The F^- anion has been shown to be one of the most effective catalysts for the polycondensation of silica gels. The analysis of the Guinier and Porod regions of the scattering curves yields valuable information about the particle size, the structural evolution and the growth process of these systems. The theoretical concepts of percolation and fractal geometry are applied to interpret the experimental results and to compare them with computer simulations for different growth processes in order to ascertain the origin of the developing random polymer network structure. The effects of adding a strong nucleophilic catalyst, such as NaF, on the structural properties and the growth mechanism of silicon polymer in the course of the sol-gel transition is discussed.

5541 (CONF-8911112–2) **Development of a process for treating red water by organic/inorganic separation and biodegradation.** Chaiko, D.J.; Reichley-Yinger, L.; Orth, E.R.; Van Deventer, E.H.; Vandegrift, G.F.; Krumpole, M.; Helt, J.E.; Coleman, R.D.; Kakar, S.N.; Tsai, T.S.; Horken, K.; Killian, W.; Sather, N.F. Argonne National Lab., IL (USA). [1989]. 12p. Sponsored by U.S. Department of Defense. DOE Contract W-31109-ENG-38. From 14. annual Army environmental R and D symposium; Williamsburg, VA (USA); 14-16 Nov 1989. Order Number DE90003557. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The final stage of TNT production involves the purification of TNT by selective conversion of the unsymmetrical isomers into water-soluble sulfonates by reaction of the crude TNT with an aqueous sulfite (sellite) solution. This treatment generates an intense, red-colored waste stream commonly referred to as "red water," which has been listed as a hazardous waste by the EPA. Its composition is primarily soluble organic sulfonates and the sodium salts of sulfate, sulfite, nitrate and nitrite. Argonne National Labcratory (ANL) is developing a process for treating red water. This process couples the separation of the organic and inorganic constituents of red water, followed by treatment of the organics by biodegradation to nonhazardous products. Sludge formation in the biotreatment step is further minimized by conversion of the sodium-containing organics to their respective acidic forms during the organic/inorganic separation. The level of separation will be such that the inorganic residues can qualify as nonhazardous byproducts. Initial efforts have been directed towards performing proof-of-concept demonstrations of processes that can achieve these goals. Candidate technologies that are being examined for separating the organic constituents from actual red water samples are (1) flocculation, (2) foam fractionation, and (3) aqueous biphasic solvent extraction. 22 refs.

5542 (ENEA-RT-COMB–89-09) **On-line control systems for solvent extraction processes: Feedback regulation of solvent.** Aparo, M.; Casarci, M.; Vicini, C.; Siepe, V.; Di Gennaro, S. ENEA, Casaccia (Italy). Dipt. Ciclo del Combustibile; ENEA, Trisaia (Italy). Dipt. Ciclo del Combustibile. Jun 1989. 55p. (In Italian). Order Number DE90724680. Available from NTIS (US Sales Only), PC A04/MF A01.

The present work describes the characteristics of an automatic system for the control of solvent extraction processes. Such a control is based on a feed-back regulation of the solvent flow rate in order to keep the product composition constant and to minimize the loss in the raffinate. The behaviour of the system, consisting of a densitometer (for on-line measurements of the final product), a flow regulator and a microprocessor control unit, was studied from theoretical and experimental points of view.

5543 (GKSS–89/E/29) **Total reflection X-ray spectrometry: Method and applications.** Prange, A. (GKSS-Forschungszentrum Geesthacht GmbH, Geesthacht-Tesperhude (Germany, F.R.). Inst. fuer Physik). GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.). 1989. 18p. Available from Special print from Spectrochim. Acta, Part B (1989) v. 44(5) p. 437-452.

Total reflection X-ray fluorescence, abbreviated as TXRF, is a relatively young method for the determination of trace elements. It is a special variant of energy dispersive X-ray fluorescence analysis. The detection power of the TXRF method is 2-3 orders of magnitude better than that of conventional XRF, and allows multielement determination down to the ultra trace concentration level. The possibility of internal standardization based on an inherent universal calibration curve, the simple sample preparation and the minute sample masses required also make TXRF useful for routine investigations. The TXRF method is described and its characteristic features are elucidated; several examples of applications to aqueous and solid samples from the environment are given, demonstrating the capability of TXRF. (orig.).

5544 (IAEA-TECDOC–520) **Technical and economic benefits of nuclear techniques in ore processing. Report of an advisory group meeting held in Krakow, Poland, 24-28 October 1988.** International Atomic Energy Agency, Vienna (Austria). Aug 1989. 75p. (CONF-8810450–: Advisory group on technical and economic benefits of nuclear techniques in ore processing, Krakow (Poland), 24-28 Oct 1988). Order Number DE90607841. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

This report is the outcome of an Advisory Group Meeting organized by the Agency and hosted by the Institute of Physics and Nuclear Techniques, the Academy of Mining and Metallurgy in Krakow, Poland. The purpose of the meeting was to assess the technical and economic benefits of applying nuclear techniques in

ore processing industry. Nucleonic control systems and nuclear on-line analytical techniques as well as radioisotope tracer tests and their applications in metallic ore-processing, coal production, and cement fabrication were discussed. This report contains a summary and the presentations dealing with nuclear techniques for process control made at this meeting. Using a number of case-histories as examples, it illustrates technical and economic benefits obtainable by the installation of nuclear process control instrumentation. It is expected to be useful for everybody dealing with ore and coal production, but especially for administrative personnel and engineers who plan and implement national development programmes related to mineral resources. Refs, figs and tabs.

5545 (IAEA-TECDOC–520, pp. 13-24) **Benefits of using radioisotope on-line analysis gauges in the Australian coal industry.** Sowerby, B.D. (Commonwealth Scientific and Industrial Research Organization, Menai (Australia). Div. of Mineral and Process Engineering). International Atomic Energy Agency, Vienna (Austria). Aug 1989. (CONF-8810450–: Advisory group on technical and economic benefits of nuclear techniques in ore processing, Krakow (Poland), 24-28 Oct 1988). In *Technical and economic benefits of nuclear techniques in ore processing. Report of an advisory group meeting held in Krakow, Poland, 24-28 October 1988.* Order Number DE90607841. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

The Commonwealth Scientific and Industrial Research Organisation (CSIRO) has developed and commercialized nuclear gauges for the on-line determination of ash in coal and for the in-stream determination of solids fraction and ash in coal slurries. Also a nuclear technique is being commercialized for the on-line determination of moisture in coke. The use of these nuclear gauges is already resulting in substantial savings in the coal industry. In mid-1988, 61 Coalscan on-line ash gauges based on the above developments had been sold worldwide to a total value of about US$10 million (1988 dollars). These gauges are used in a wide range of applications including mine grade control, coal sorting, coal preparation plant control, coal blending and power station feed monitoring. Productivity improvements of between 1 and 3% have been reported by 12 Australian coal producers using these ash gauges. It is conservatively estimated that the total benefit to the Australian coal industry is about US$22 million per year. (author). 17 refs, 8 figs, 3 tabs.

5546 (IAEA-TECDOC–520, pp. 33-42) **Status and potential of nuclear techniques in ore processing and coal handling in Asia and the Pacific.** Rao, S.M. (UNDP/IAEA Regional Industrial Project, CAIR/BATAN, Jakarta (Indonesia)). International Atomic Energy Agency, Vienna (Austria). Aug 1989. (CONF-8810450–: Advisory group on technical and economic benefits of nuclear techniques in ore processing, Krakow (Poland), 24-28 Oct 1988). In *Technical and economic benefits of nuclear techniques in ore processing. Report of an advisory group meeting held in Krakow, Poland, 24-28 October 1988.* Order Number DE90607841. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

The UNDP/IAEA/RCA Regional Industrial Project aims at extended use of isotopes and radiation technology in industries in Asia and the Pacific region. The programme includes the use of Nucleonic Control Systems (NCS) in the mineral industry. An intensive training/demonstration programme conducted in Phase I (1982-1986) using an on-stream analyser (OSA) installed in a copper concentrator in the Philippines helped in the dissemination of information on NCS in the region. The OSA's and laboratory type isotope-based analysers being used in the region's mineral industry are reportedly yielding substantial economic and technical benefits. Future potential of nuclear methods in ore processing in the region appears to be very good. In Phase II (1987-1992), the Regional Project is organizing a similar activity in coal. One Regional Executive Management Seminar was conducted in Australia last year and it is now proposed to install a nucleonic coal-ash monitor in a lignite mine in Thailand and use the installation for an intensive training/demonstration programme for the benefit of the regional coal industry. (author).

5547 (IAEA-TECDOC–520, pp. 43-48) **Benefits of automatic multielemental analysis of zinc-lead ore slurries by radioisotope X-ray fluorescence.** Holynska, B. (Institute of Physics and Nuclear Techniques, Cracow (Poland)); Lankosz, M.; Ostachowicz, J.; Wesolowski, T.; Zalewski, J. International Atomic Energy Agency, Vienna (Austria). Aug 1989. (CONF-8810450–: Advisory group on technical and economic benefits of nuclear techniques in ore processing, Krakow (Poland), 24-28 Oct 1988). In *Technical and economic benefits of nuclear techniques in ore processing. Report of an advisory group meeting held in Krakow, Poland, 24-28 October 1988.* Order Number DE90607841. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

The radioisotope X-ray fluorescence measuring system has been developed for automatic multielement analysis of zinc-lead ore slurries. The system consists of several XRF measuring probes, electronic unit and minicomputer with its peripherals. The system has been used for simultaneous determination of Fe, Zn and Pb in flotation streams with accuracy within 3-15%, depending on metal concentration. Improved control of the flotation process resulting from on-stream analysis has led to increases of up to 3.4% in metal recovery. (author). 3 refs, 4 figs, 1 tab.

5548 (IAEA-TECDOC–520, pp. 49-55) **Benefits of automatic measurement of heavy metal concentration in aqueous process solutions by means of X-ray fluorescence with an isotope radiation source.** Leonhardt, J.W. (Akademie der Wissenschaften der DDR, Leipzig (German Democratic Republic). Zentralinstitut fuer Isotopen- und Strahlenforschung); Bruchertseifer, H.; Eckert, B.; Morgenstern, P.; Riedel, W. International Atomic Energy Agency, Vienna (Austria). Aug 1989. (CONF-8810450–: Advisory group on technical and economic benefits of nuclear techniques in ore processing, Krakow (Poland), 24-28 Oct 1988). In *Technical and economic benefits of nuclear techniques in ore processing. Report of an advisory group meeting held in Krakow, Poland, 24-28 October 1988.* Order Number DE90607841. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

The benefits of a new automatic X-ray fluorescence method are described. It is successfully used for carrying out express analysis of uranium in the flow of solutions. The sensitivity threshold for the determination is nearly 50 ppb. The analyzer properly combines: a system for sampling and solution modification, a radiochemically proved step for the selective preconcentration of the interesting metal traces, and the X-ray fluorescence analysis, including a sealed proportional scintillation counter as detection instrument, and a radioactive source for the excitation of the sample. The X-ray fluorescence analyzer RFAA-30 is controlled by a compatible personal computer and cannot only be integrated into industrial control systems but also used in labs. There is expected an increasing importance of such type of an analyzer because other important heavy elements such as Ag, Cd, Cu, Ni, rare earths, platinum metals, Au, Hg and Tl can be also determined. (author). 1 ref., 2 figs.

5549 (IAEA-TECDOC–520, pp. 57-66) **Photoactivation analysis of copper in copper ore and flotation products.** Czajowski, W. (United Lower Silesian Copper Mines, Lubin (Poland)). International Atomic Energy Agency, Vienna (Austria). Aug 1989. (CONF-8810450–: Advisory group on technical and economic benefits of nuclear techniques in ore processing, Krakow (Poland), 24-28 Oct 1988). In *Technical and economic benefits of nuclear techniques in ore processing. Report of an advisory group meeting held in Krakow, Poland, 24-28 October 1988.* Order Number DE90607841. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

This paper details a photoactivation analysis method for estimation of copper in copper ore and flotation products. The reaction $^{63}Cu\ (\gamma,n)^{62}Cu+\beta^{+}$ results in annihilation radiation which is measured by gamma spectrometry with time resolution $1\text{-}2\times10^{-7}$ nanoseconds. The paper describes the analytical system using this method. The method has been found useful not only for determination of Cu in ore and flotation products but for determination of Pb, Zn and Ag. The method is very fast, inexpensive and avoids the use of noxious and corrosive chemicals which are required for conventional methods of assay. (author). 3 figs, 1 tab.

5550 (IAEA-TECDOC–520, pp. 67-73) **Benefits of nuclear methods in lignite processing.** Leonhardt, J.W. (Akademie der Wissenschaften der DDR, Leipzig (German Democratic Republic). Zentralinstitut fuer Isotopen- und Strahlenforschung); Goeldner, R. International Atomic Energy Agency, Vienna (Austria). Aug 1989. (CONF-8810450–: Advisory group on technical and economic benefits of nuclear techniques in ore processing, Krakow (Poland), 24-28

Oct 1988). In *Technical and economic benefits of nuclear techniques in ore processing. Report of an advisory group meeting held in Krakow, Poland, 24-28 October 1988.* Order Number DE90607841. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Lignite is the basis for power stations, gasification, coking and heating in the G.D.R. The geological conditions in the open-cast mines grow continuously more complex leading to a rather rapid change of the composition and quality of the coal hauled. Therefore the control of coal quality is important at several points in the coal production/consumption circuit. During the last years a lot of radiometric ash monitors based on different methods has been developed worldwide, built and checked at streams of both processed and unprocessed black coal and partly lignite too. Recently some well-known concepts could be improved matching the characteristics of the coal stream applying on-line data processing using microcomputer techniques. The range of activities of the CIIRR in this field comprises both basic research and applied work. To solve the problems of the ash content measurement of lignite in a reliable and economical manner, two radiometric systems named KRAS (complex radiometric analysis system) and SIACON (silicon activation on-line) were developed and introduced into the practice of the mining and processing of brown coal. Data processing is carried out by a microcomputer. (author). 6 refs, 3 figs.

5551 (INCT–2021/8/E/B) **Time regimes optimization of the activation-measurement cycle in neutron activation analysis.** Szopa, Z. Institute of Nuclear Chemistry and Technology, Warsaw (Poland). 1986. 29p. (In Polish). Order Number DE90610731. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Criteria of the optimum time conditions of the activation-measurement cycle in neutron activation analysis have been formulated. The optimized functions i.e. the relative precision or the factor of "merit" of the analytical signal measured as functions of the cycle time parameters have been proposed. The structure and possibilities of the optimizing programme STOPRC have been presented. This programme is completely written in FORTRAN and takes advantage of the library of standard spectra and fast, stochastic algorithms. The time conditions predicted with the aid of the programme have been discussed and compared with the experimental results for the case of the determination of tungsten in industrial dusts. 31 refs., 4 figs. (author).

5552 (INIS-mf–11542) **AQCS 1989 - Intercomparison runs reference materials.** International Atomic Energy Agency, Seibersdorf (Austria). Analytical Quality Control Services. Jan 1989. 72p. Order Number DE90609294. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

The purpose of the Analytical Quality Control Services (AQCS) programme provided by the International Atomic Energy Agency (Agency) is to assist laboratories engaged in the analysis of nuclear, environmental, biological, and materials of marine origin for radionuclide, major, minor and trace elements, as well as stable isotopes using atomic and nuclear analytical techniques, to check the quality of their work. Reference Materials available are listed by origin and by analyte giving referenced values and confidence intervals. Only materials, which have one or more properties sufficiently well established from statistical evaluation of previous interlaboratory comparison studies are included. Existing Reference Materials may be updated for previously referenced constituents or properties according to the results of the Agency's Co-ordinated Research Programmes (CRPs) in these fields or according to recently published literature values. They are supplied with a reference sheet stating relevant parameters and properties of the material and can be used as secondary standards for quality control assurance within a laboratory, for checking analytical methods and/or instrumentation or for training purposes. 4 tabs.

5553 (PB–89-235642/XAB) **Determination of trace-level iodine in biological and botanical reference materials by isotope-dilution mass spectrometry.** Gramlich, J.W.; Murphy, T.J. National Inst. of Standards and Technology, Gaithersburg, MD (USA). 1989. 6p. Available from NTIS, PC A04.

Included in Jnl. of Research of the National Institute of Standards and Technology, Vol. 94, No. 4, 215-220(Jul-Aug 1989).

A method was developed for the determination of trace-level iodine in biological and botanical materials. The method consists of spiking a sample with ^{129}I, equilibration of the spike with the natural iodine, wet ashing under carefully controlled conditions, and separation of the iodine by co-precipitation with silver chloride. Measurement of the $^{129}I/^{127}I$ ratio is accomplished by negative thermal ionization mass spectrometry using LaB_6 for ionization enhancement. The application of the method to the certification of trace iodine in two Standard Reference Materials is described.

5554 (PB–89-237358/XAB) **Analysis of volatile organic chemicals in aqueous samples by purge/GC (gas chromatography) with selective water removal.** Cochran, J.W.; Henson, J.M. Northrop Services, Inc., Ada, OK (USA). Dec 1988. 7p. Available from NTIS, PC A02/MF A01.

Pub. in Jnl. of High Resolution Chromatography and Chromatography Communications, Vol. 11, No. 12, 869-873(Dec 1988).

A gas-chromatographic method for volatile organic chemicals in which an aqueous sample is purged directly to a cryogenically cooled, fused-silica column uses a Nafion tube drier between the purge vessel and GC column. The Nafion strips water from the gas stream during the purge step while allowing volatile halocarbons and aromatics to continue to the GC column. Examples of the technique are presented on 0.53-m and 0.25-mm fused-silica columns coated with a variety of stationary phases.

5555 (PB–89-873392/XAB) **Liquid membranes. January 1970-August 1989 (Citations from the COMPENDEX data base). Report for January 1970-August 1989.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 131p. Available from NTISPC N01/MF N01.

Supersedes PB–88-858642.

This bibliography contains citations concerning the development and utilization of liquid membranes and liquid-membrane process techniques. Topics include ion-transport properties of membranes, modeling studies, and investigations of potential distribution and diffusion phenomena. Applications include medicine, gas separation, biochemisty, metals separation and recovery, waste water treatment, and solute extraction. (This updated bibliography contains 296 citations, 214 of which are new entries to the previous edition.)

5556 (PNL-SA–16112) **Development of a robotics system for automated chemical analysis of sediment, sludges, and soils.** McGrail, B.P. (Pacific Northwest Lab., Richland, WA (USA)); Dodson, M.G.; Skorpik, J.R.; Strachan, D.M.; Barich, J.J. Pacific Northwest Lab., Richland, WA (USA). Nov 1989. 6p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-891103–58: Winter meeting of the American Nuclear Society, San Francisco, CA (USA), 26-30 Nov 1989). Order Number DE90003637. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The introduction of automation technology into the analytical laboratory holds the promise of higher efficiency, improved productivity, and lower costs. However, the conventional "laboratory robot" widely used today may not offer the work envelope or reliability required in a high workload laboratory performing quality control or environmental analytical services. To address this need, a demonstration workcell was assembled utilizing an industrial-class robotics system to automate a standard EPA acid digestion protocol. With further development of graphical user interfaces and error recovery software, the technology will significantly enhance the ability of laboratories to meet increasingly complex environmental demands. 7 refs., 2 figs., 1 tab.

5557 (RISO-M–2790) **Use of ^{15}N enriched plant material for labelling of soil nitrogen in legume dinitrogen fixation experiments.** Jensen, E.S. Risoe National Lab., Roskilde (Denmark). Jun 1989. 27p. Order Number DE90610737. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The soil nitrogen in a field plot was labelled with nitrogen-15 (15N) by incorporating labelled plant material derived from previous experiments. The plot was used the following 3 years for determination of the amount of N2 fixed by different leguminous plants. The atom % 15N excess in grains of cereals grown as reference crops was 0.20, 0.05 and 0.03 in the 3 years, respectively. In the first year the level of enrichment was adequate for estimating symbiotic nitrogen fixation. In the second and third year lack of precision in determination of the 15N/14N ratios of legume N, may have caused an error in

estimates of nitrogen fixation. About 23% of the labelled N was taken up by plants during the 3 years of cropping; after 4 years about 44% of the labelled N was found still to be present in the top soil. The labelling of the soil nitrogen with organic bound 15N, compared to adding mineral 15N at sowing, is advantageous because the labelled N is released by mineralization so that the enrichment of the plant available soil N pool become more uniform during the growth season; and high levels of mineral N, which may depress the fixation process, is avoided. (author) 7 tabs., 1 ill., 30 refs.

5558 (RISO-M–2792) **The migration chemistry of neptunium.** Nilsson, K.; Carlsen, L. Risoe National Lab., Roskilde (Denmark). May 1989. 28p. Order Number DE90610738. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The chemistry of neptunium, including redox properties, complex chemistry and chemistry of neptunium in its five oxidation states, III, IV, V, VI and VII has been reviewed with special emphasis on factors, which may be of importance in controlling the environmental behaviour of this element. Under environmental conditions neptunium should exist predominantly in oxidation state V in the form NpO2+ and to some extent also as Np (IV) in the form of Np4+ and Np (VI) in the form of NpO22+, whereas the other oxidation states Np (III) and Np (VII) can not exist in the environment. However, experimental evidence is lacking as is any knowledge about the mobility of neptunium in the environment. (author) 15 tabs., 2 ills., 37 refs.

5559 (SAND–89-0965C) **Outlier detection in multivariate calibration.** Thomas, E.V.; Haaland, D.M. Sandia National Labs., Albuquerque, NM (USA). [1989]. 22p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-891113–3: American Institute of Chemical Engineers annual meeting, San Francisco, CA (USA), 5-10 Nov 1989). Order Number DE90001502. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Outlier samples can have very detrimental effects on the performances of multivariate calibration methods, as these methods are generally not very robust. Often, the software implementations of these methods do not check for outliers. If outliers are not detected, invalid predictions may result. This paper illustrates some simple exploratory procedures for detecting outliers with examples from near-infrared and mid-infrared spectroscopy using partial least-squares regression as the calibration method. 8 refs., 9 figs., 1 tab.

5560 (UzIYaF-R–3-336) **Chemical elements in cotton materials.** Kim, A.P.; Orestova, I.I. AN Uzbekskoj SSR, Tashkent (USSR). Inst. Yadernoj Fiziki. 1988. 20p. (In Russian). Order Number DE90609295. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The elemental composition of cotton materials: fibres, seeds according to mature degree, selectional and industrial sorts and other factors has been studied by neutron activation analysis. It has been demonstrated, that elemental composition of cotton fibre has high correlation with mature degree, and chemical elements spread in cotton fibre is similar with high reliability to spread in universe, coal and in mulburry-tree leaves. 22 refs.; 4 figs.; 9 tabs.

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Refer also to citation(s) 4751, 4873, 4875, 5183, 5422

5561 (AD-A–211432/0/XAB) **Energy conversion at the molecular level.** Meyer, T.J. North Carolina Univ., Chapel Hill, NC (USA). Dept. of Chemistry. 1989. 23p. Available from NTIS, PC A03/MF A01.

Many small-molecule reactions are candidates for light to chemical energy conversion such as water splitting. The processes of importance in excited state electron transfer schemes depend upon the fundamental principles of chemistry and physics. From those principles, equations can be derived, which give quantitative or semiquantitative insight into quantum yields and rates. In turn, those equations are couched in terms of the molecular properties of the system. Between the underlying principles and an appropriate manipulation of properties, it does appear that it should be possible to dictate the rates and quantum yields of charge separation in molecular systems in a systematic way.

5562 (DOE/ER/13288–5) **Gas-liquid-liquid equilibria in mixtures of water, light gases, and hydrocarbons: Progress report, December 1, 1988–November 30, 1989.** Chao, K.C. Purdue Univ., Lafayette, IN (USA). School of Chemical Engineering. [1989]. 1p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-84ER13288. Order Number DE90003180. Available from NTIS, PC A02/MF A01 - OSTI.

A Simplified augmented BACK equation of state has been developed for the description of gas-liquid-liquid equilibria in mixtures of water, light, gases, and hydrocarbons. The simplification facilitates application of the equation. In the Augmented BACK equation the polar pressure of water is the difference between two long expressions. One of these is the 26-term BACK equation written for the non-polar core of the water molecule, and the other is the Keeman steam table equation containing 55 equation constants. The complexity is compounded when derivation is made of the equation for fugacity, enthalpy and other thermodynamic quantities, leading to working equations that contain more than one hundred terms. The complexity presents a barrier to useful application. The new simplified equation has been extensively tested. Calculations with the Augmented BACK equation (before simplification) are described with example mixtures. Included are mixtures of water + light gases, water + hydrocarbons, and polar substances in general. Phase equilibrium, density, and enthalpy are calculated. 3 figs.

5563 (DOE/ER/13460–T2) **[Energies of organic compounds].** Wiberg, K.B. Yale Univ., New Haven, CT (USA). [1989]. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER13460. Order Number DE90003174. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The first part of our study of the enthalpy of reduction of carbonyl compounds has been completed and includes four aldehydes, acetone, a series of cyclic ketones and ethyl acetate. The results suggest that some of the literature data for these compounds are significantly in error. Equilibrium constants have been measured for the reaction of carbonyl compounds with water to give hydrates as well as with methanol to give either hemiacetals or acetals. They cover a wide range, and studies are underway to determine the reasons for the differences. Studies of the enthalpies of hydration of some alkenes which yield tertiary alcohols have been completed, as well as a study of the hydrolysis of lactones. The "gauche effect" has been studied, and has been shown to result from the formation of bent bonds when atoms of much different electronegativity are joined.

5564 (DOE/ER/13773–2) **Model catalyst studies of active sites and metal support interactions on vanadia and vanadia-supported catalysts: Progress report, December 1, 1988–November 30, 1989.** Henrich, V.E. (Yale Univ., New Haven, CT (USA). Dept. of Applied Physics). Yale Univ., New Haven, CT (USA). Dept. of Applied Physics. Sep 1989. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER13773. Order Number DE90003179. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We have been proceeding in several directions in our studies of vanadia catalysts and the interaction between catalyst metal atoms and oxide supports. Working with Dr. Tony Cox of the Inorganic Chemistry Laboratory, Oxford University, who spent two months at Yale this past spring, we have considered ways to adapt Dr. Cox's Fourier transform method of removing surface phonon overtones from HREELS spectra to the cases of oxides that are supporting small metal particles and of very thin oxide layers on a different oxide. The electronic structure of model TiO_2 catalyst support surfaces has been studied by means of a series of photoemission experiments conducted at the National Synchrotron Light Source, Brookhaven National Laboratory. Using tunable energy photons from the VUV storage ring, we performed resonant photoemission experiments on both stoichiometric and reduced TiO_2 (110) surfaces in order to obtain information about the hybridization of cation and anion electronic states on the surface. Initial studies of the interaction of water with both stoichiometric and defect TiO_2 surfaces using resonant photoemission were also conducted. Work on the electronic properties of vanadia surfaces concentrated on single-crystal V_2O_5, since we were recently able to obtain a sample from

Bell Laboratories, and on the deposition of V atoms onto single-crystal TiO_2 supports. The V_2O_5 model catalyst work is necessary in order to understand what types of sites are the active ones in real V_2O_5 catalysts. The model supported V experiments will try to determine the interactions that take place between V, Ti and O ions in titania-supported vanadia catalysts. 9 figs.

5565 (DOE/ER/13914–13) **Interfacial systems for photochemical energy conversion: Progress report, December 1, 1988–November 30, 1989.** Wrighton, M.S. Massachusetts Inst. of Tech., Cambridge, MA (USA). [1989]. 26p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER13914. Order Number DE90003181. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report covers DOE-supported progress for the period 12/1/88–11/30/89 and outlines plans for the period 12/1/89–11/30/90, the final year of a three year grant. Research supported by the DOE falls in the areas of (1) multicomponent redox molecules; (2) polymer-modified electrodes and semiconductor photoelectrodes; (3) semiconductor surface chemistry; and (4) multielectron transfer biological catalysts for redox energy conversion processes. Highlights of research in these areas will be given in this report. In each sub-section below plans for the concluding year of the grant are summarized. 6 figs.

5566 (DOE/ER/13945–1) **[High temperature chemistry of aromatic hydrocarbons]: Progress report.** Scott, L.T. Nevada Univ., Reno, NV (USA). Nov 1989. 2p. Sponsored by U.S. DOE Energy Research. DOE Contract FG08-88ER13945. Order Number DE90003664. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This project focuses on the molecular transformations of aromatic hydrocarbons at high temperatures. Some of the studies make use of readily available compounds; however, others require lengthy organic syntheses. Two studies of each type are summarized herein.

5567 (DOE/ER/60648–2) **Studies of the formation chemical reactivity and properties of small clusters: Application to an understanding of aerosol formation and heterogeneous chemistry.** Castleman, A.W. Jr. Pennsylvania State Univ., University Park, PA (USA). Dept. of Chemistry. [1989]. 45p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER60648. Order Number DE90003387. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The overall objective of the work is to provide basic underpinning research that will contribute to a quantification of the behavior of pollutants and radionuclides associated with advanced energy activities after these materials emanate from their source and are transferred through the environment to the biota and human receptor. Data is being acquired on photoinduced transformation of pollutants including reactions which take place on aerosol particles, as well as those of species which become transformed into aerosols as a result of their chemical and physical interactions. The studies also provide critical information on problems in radiation biology and include investigations of reactions of molecules, which simulate functional groups in biological systems, as they proceed following the absorption of ionizing radiation.

5568 (ETDE-IT–89-26) **4th International symposium on second law analysis of thermal systems.** Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica. [1987]. 73p. (In Italian). (CONF-8705391–1: 4. international symposium on second law analysis of thermal systems, Rome (Italy), 25-30 May 1987). Order Number DE90705982. Available from NTIS (US Sales Only), PC A04/MF A01.

Paper presented at 4th International symposium on second law analysis of thermal systems (Rome 25-30 May 1987).

Individual papers in scope for the data base are processed separately. (DLC)

5569 (INIS-SU–129, pp. 66-67) **Ellipsometric investigation of the surface of $LiIO_3$ growing crystal in situ.** Tronin, A.Yu. (AN SSSR, Moscow (USSR). Inst. Kristallografii). AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy; 7. All-Union conference on crystal growth, Moscow (USSR); Moscow (USSR), 14 Nov 1988; 14 nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 5 refs.; 1 fig. IODATES/crystal growth; IODATES/surfaces; BOUNDARY LAYERS; IODATES; SURFACES; KINETICS; LITHIUM COMPOUNDS; MONOCRYSTALS; QUANTITY RATIO; SOLUTIONS; SUPERSATURATION

5570 (INIS-SU–129, pp. 87-88) **Investigation of microimpurities interaction during lithium iodate single crystal growth.** Rozin, K.M. (Moskovskij Inst. Stali i Splavov, Moscow (USSR)); Portnov, O.G.; Vasil'eva, L.V.; Morozov, V.I.; Kozlova, N.S.; Geras'kin, V.V. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 6 refs. IODATES/crystal growth; IODATES/impurities; LITHIUM COMPOUNDS/impurities; AQUEOUS SOLUTIONS; COBALT 57; CRYSTALLIZATION; DISTRIBUTION FUNCTIONS; IODATES; IMPURITIES; IRON 59; MANGANESE 54; MONOCRYSTALS; SURFACES; TRACE AMOUNTS; TRACER TECHNIQUES; ZINC 65

5571 (INIS-SU–129, pp. 90-91) **Effect of the α-$LiIO_3$ crystal growth conditions on their acoustic characteristics in a wide range of frequencies and temperatures.** Abramovich, A.A. (Leningradskij Gosudarstvennyj Univ., Leningrad (USSR). Nauchno-Issledovatel'skij Fizicheskij Inst.); Alchangyan, S.V.; Vorob'ev, V.V.; Kuleshov, A.A.; Kul'bitskaya, M.N.; Charnaya, E.V. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: 7. All-Union conference on crystal growth; Symposium on molecular beam epitaxy, Moscow (USSR); Moscow (USSR), 14 Nov 1988; 14 nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 2 refs.; 1 fig. IODATES/crystal growth; HEXAGONAL LATTICES; IODATES; LITHIUM COMPOUNDS; MONOCRYSTALS; PH VALUE; PHYSICAL PROPERTIES; ULTRASONIC WAVES

5572 (INIS-SU–129, pp. 94-95) **Growth of lithium iodate monocrystals of high optical quality.** Alchangyan, S.V.; Amirkhanyan, G.K. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. IODATES/crystal growth; AQUEOUS SOLUTIONS; IODATES; KINETICS; LITHIUM COMPOUNDS; MONOCRYSTALS; OPTICAL PROPERTIES

5573 (INIS-SU–129, pp. 96-97) **Investigation of conditions of crystal growth of lithium iodate for effective transformation of laser radiation.** Balasanyan, R.N.; Oganesyan, A.S.; Pogosyan, S.P. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. IODATES/crystal growth; ABSORPTION SPECTRA; AQUEOUS SOLUTIONS; DENSITY; IODATES; IODIC ACID; LASER RADIATION; LITHIUM COMPOUNDS; MONOCRYSTALS; PH VALUE; QUANTITY RATIO

5574 (INIS-SU–129, pp. 101-102) **Preparation of monocrystals of the type $[(CH_3)_2NH_2]_2MeCl_4$ (Me: Zn, Co, Cu, Cd, Mn, Ba).** Bobrova, Z.A. (Minskij Radiotekhnicheskij Inst., Minsk (Byelorussian SSR)); Varikash, V.M.; Gabets, P.S. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. CADMIUM COMPLEXES/chemical preparation; CADMIUM COMPLEXES/crystal growth; AMINES; AQUEOUS SOLUTIONS; CHLORIDES; CRYSTALLIZATION; MEDIUM TEMPERATURE; MONOCRYSTALS; SOLUBILITY

5575 (INIS-SU–129, pp. 119-120) **New crystals of ethylenediammonium iodates.** Petrosyan, A.M. (Erevanskij Gosudarstvennyj Univ., Erevan (USSR)); Shishkin, V.A.; Anastasyan, R.R.; Akopyan, Eh.A. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 4 refs. IODATES/chemical preparation; IODATES/crystal growth; IODATES/phase studies; AMINES; CHEMICAL COMPOSITION; CRYSTALS; IODATES; MOLECULAR STRUCTURE; PYROLYSIS; QUANTITY RATIO

5576 (INIS-SU–129, pp. 138-139) **On the peculiarities of growth and defects of potassium pentaborate monocrystals.** Isaenko, L.I.; Pyl'neva, N.A.; Eliseev, A.P.; Lisojvan, V.I. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 1 ref.; 2 figs. BORATES/crystal defects; BORATES/crystal growth; BORATES; HYDRATES; MEDIUM TEMPERATURE; MONOCRYSTALS; PH VALUE; POTASSIUM COMPOUNDS

5577 (INIS-SU–129, pp. 171-172) **Microscopic model of hydrothermal crystallization of A, Me-silicates (germanates) and derivation of 73 dimer complexes.** Ilyushin, G.D. (AN SSSR, Moscow (USSR). Inst. Kristallografii). AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. ALKALI METAL COMPOUNDS/crystal structure; ALKALI METAL COMPOUNDS/crystallization; HAFNIUM SILICATES/crystal structure; HAFNIUM SILICATES/crystallization; ZIRCONIUM SILICATES/crystal structure; ZIRCONIUM SILICATES/crystallization; CRYSTALLIZATION; AQUEOUS SOLUTIONS; CHEMICAL COMPOSITION; DIMERS; GERMANATES; HIGH TEMPERATURE; MATHEMATICAL MODELS

5578 (INIS-SU–129, pp. 187-188) **Synthesis and spectral-luminescence investigations of $K_2Y_{1-x}Er_xF_5$ monocrystals.** Khajdukov, N.M. (AN SSSR, Moscow (USSR). Inst. Obshchej i Neorganicheskoj Khimii); Pimenov, V.A.; Studenikin, M.I. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: 7. All-Union conference on crystal growth, Moscow (USSR), 14 Nov 1988). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 3 refs.; 1 fig. ERBIUM FLUORIDES/chemical preparation; ERBIUM FLUORIDES/crystal growth; ERBIUM FLUORIDES/luminescence; YTTRIUM FLUORIDES/chemical preparation; YTTRIUM FLUORIDES/crystal growth; YTTRIUM FLUORIDES/luminescence; AQUEOUS SOLUTIONS; CRYSTALLIZATION; LUMINESCENCE; HIGH TEMPERATURE; MONOCRYSTALS; POTASSIUM FLUORIDES; VERY HIGH PRESSURE

5579 (INIS-SU–129, pp. 189-190) **Hydrothermal synthesis of $KLnF_4$ crystals.** Khajdukov, N.M. (AN SSSR, Moscow (USSR). Inst. Obshchej i Neorganicheskoj Khimii); Stefanovich, S.Yu.; Zibrov, I.P.; Dem'yanets, L.N.; Fedorov, P.P. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 3 refs.; 1 fig. RARE EARTH COMPOUNDS/chemical preparation; RARE EARTH COMPOUNDS/crystal growth; YTTRIUM FLUORIDES/chemical preparation; YTTRIUM FLUORIDES/crystal growth; AQUEOUS SOLUTIONS; CHEMICAL BONDS; CHEMICAL COMPOSITION; CRYSTAL LATTICES; HIGH TEMPERATURE; POTASSIUM FLUORIDES; SENSITIVITY; THERMAL DEGRADATION; VERY HIGH PRESSURE

5580 (INIS-SU–129, pp. 196-198) **Crystal growth beryllium oxides and silicates with the use of fluxes.** Bukin, G.V. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 3 refs.; 2 figs. BERYLLIUM OXIDES/crystal growth; BERYLLIUM SILICATES/crystal growth; KINETICS; METALLURGICAL FLUX; PHASE STUDIES; QUANTITY RATIO; VERY HIGH TEMPERATURE

5581 (INIS-SU–129, pp. 268-269) **Study of conditions of liquid-phase epitaxy of $InAs_{1-x}Sb_x$ solid slutions on InAs and GaSb substrates.** Akchurin, R.Kh. (Moskovskij Inst. Tonkoj Khimicheskoj Tekhnologii, Moscow (USSR)); Zhegalin, V.A.; Lizets, T.T.; Ufimtsev, V.B. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy; 7. All-Union conference on crystal growth, Moscow (USSR); Moscow (USSR), 14 Nov 1988; 14 nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 3 refs. INDIUM ARSENIDES/epitaxy; INDIUM ARSENIDES/solid solutions; ANTIMONIDES; CHEMICAL COMPOSITION; HIGH TEMPERATURE; EPITAXY; SUBSTRATES

5582 (INIS-SU–129, pp. 206-207) **Growth of La_2CuI_4 monocrystals by crystallization from solution in melt.** Borik, M.A. (AN SSSR, Moscow (USSR). Inst. Obshchej Fiziki); Voronov, V.V.; Gamayunov, K.V.; Ivanov, A.V.; Lavrishchev, S.V.; Osiko, V.V.; Tatarintsev, V.M.; Chernov, A.I. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 2 figs. LANTHANUM COMPOUNDS/crystal growth; LANTHANUM COMPOUNDS/orthorhombic lattices; CRYSTALLIZATION; CUPRATES; LATTICE PARAMETERS; MOLTEN SALTS; MONOCRYSTALS; SPACE GROUPS; THERMAL ANALYSIS; VERY HIGH TEMPERATURE; X-RAY DIFFRACTION

5583 (INIS-SU–129, pp. 208-209) **Physicochemical investigations and growth of lead magnoniobate monocrystals.** Bochkova, T.M. (Dnepropetrovskij Gosudarstvennyj Univ., Dnepropetrovsk (Ukrainian SSR)); Kruzina, T.V.; Pozdeeva, V.G. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 5 refs. NIOBIUM OXIDES/crystal growth; NIOBIUM OXIDES/phase studies; CERAMICS; CHEMICAL COMPOSITION; CRYSTAL LATTICES; LEAD OXIDES; MAGNESIUM OXIDES; MOLTEN SALTS; MONOCRYSTALS; QUANTITY RATIO; VERY HIGH TEMPERATURE

5584 (INIS-SU–129, pp. 215-216) **Lead magnoniobate large monocrystal growth by the method of spontaneous crystallization.** Emel'yanov, S.M. (Rostovskij-na-Donu Gosudarstvennyj Univ., Rostov-na-Donu (USSR). Nauchno-Issledovatel'skij Inst. Fiziki); Protsenko, N.P.; Zagorujko, V.A.; Sokolova, T.V. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note; 1 ref.; 1 fig. BORON OXIDES/phase diagrams; NIOBIUM OXIDES/crystal growth; NIOBIUM OXIDES/phase diagrams; CRYSTALLIZATION; LEAD OXIDES; MAGNESIUM OXIDES; MOLTEN SALTS; MONOCRYSTALS; PHASE STUDIES; QUANTITY RATIO; VERY HIGH TEMPERATURE

5585 (INIS-SU–129, pp. 217-219) **Monocrystal growth of $PbZr_{1-x}Ti_xO_3$ solid solutions.** Eremkin, V.V. (Rostovskij-na-Donu Gosudarstvennyj Univ., Rostov-na-Donu (USSR). Nauchno-Issledovatel'skij Inst. Fiziki); Smotrakov, V.G.; Fesenko, E.G. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: 7. All-Union conference on crystal growth; Symposium on molecular beam epitaxy, Moscow (USSR); Moscow (USSR), 14 Nov 1988; 14 nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 3 refs.; 1 fig.; 1 tab. ZIRCONIUM OXIDES/crystal growth; BORON OXIDES; CRYSTAL STRUCTURE; CRYSTALLIZATION; LEAD OXIDES; MOLTEN SALTS; MONOCRYSTALS; SOLID SOLUTIONS; TITANIUM OXIDES; VERY HIGH TEMPERATURE

5586 (INIS-SU–129, pp. 220-222) **Growth and emissive characteristics of sodium neodymium tungstate $Na_5Nd(WO_4)_4$ crystals.** Kozeeva, L.P. (AN SSSR, Novosibirsk (USSR). Inst. Neorganicheskoj Khimii); Pavlyuk, A.A.; Terpugov, V.S.; Berenberg, V.A. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 1 ref.; 2 figs. NEODYMIUM TUNGSTATES/crystal growth; SODIUM TUNGSTATES/crystal growth; CRYSTALLIZATION; CZOCHRALSKI METHOD; HIGH TEMPERATURE; MOLTEN SALTS; MONOCRYSTALS; OPTICAL PROPERTIES; SOLUBILITY; TEMPERATURE DEPENDENCE

5587 (INIS-SU–129, pp. 223-224) **Solution-melt crystallization of some borates with nonlinear optical properties.** Leonyuk, N.I. (Moskovskij Gosudarstvennyj Univ., Moscow (USSR)); Leonyuk, L.I.; Rezvyj, V.R.; Butuzova, G.S.; Filippova, I.G. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 2 refs.; 1 fig. BORATES/crystallization; BORATES/phase diagrams; LUTETIUM COMPOUNDS/crystallization; LUTETIUM COMPOUNDS/phase diagrams; SCANDIUM COMPOUNDS/crystallization; SCANDIUM COMPOUNDS/phase diagrams; YTTRIUM COMPOUNDS/crystallization; YTTRIUM COMPOUNDS/phase diagrams; ALUMINIUM COMPOUNDS; BARIUM COMPOUNDS; BORATES; CRYSTALLIZATION; CRYSTAL GROWTH; CRYSTAL STRUCTURE; MOLTEN SALTS; MONOCRYSTALS; SOLID SOLUTIONS

5588 (INIS-SU–129, pp. 225-226) **Growth of magnetic monocrystals of rare earth orthoferrites, orthochromites and manganites with cation and anion substitutions.** Lukina, M.M. (Moskovskij Gosudarstvennyj Univ., Moscow (USSR)). AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. RARE EARTH COMPOUNDS/crystal growth; TRANSITION ELEMENT COMPOUNDS/crystal growth; ALUMINIUM COMPOUNDS; CHEMICAL COMPOSITION; FLUORIDES; GALLIUM COMPOUNDS; MAGNETIC MATERIALS; MOLTEN SALTS; MONOCRYSTALS; OXIDES; PHASE STUDIES; SOLID SOLUTIONS; VERY HIGH TEMPERATURE

5589 (INIS-SU–129, pp. 232-233) **Cryastal growth in the system Bi_2O_3-Fe_2O_3-La_2O_3.** Murashov, V.A. (Moskovskij Inst. Radiotekhniki, Ehlektroniki i Avtomatiki, Moscow (USSR)); Rakov, D.N.; Titov, Yu.V. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 1 fig. LANTHANUM OXIDES/crystal growth; LANTHANUM OXIDES/phase diagrams; ADDITIVES; BISMUTH OXIDES; CRYSTAL LATTICES; CRYSTALLIZATION; IRON OXIDES; MOLTEN SALTS; QUANTITY RATIO; SODIUM COMPOUNDS; SPACE GROUPS

5590 (INIS-SU–129, pp. 227-229) **Crystallization study of substituted CBVG and CVG monocrystals in lead oxide melt.** Masalov, V.M. (AN SSSR, Chernogolovka (USSR). Inst. Fiziki Tverdogo Tela); Emel'chenko, G.A. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note; 3 refs.; 2 figs. INDIUM OXIDES/crystallization; INDIUM OXIDES/phase diagrams; VANADIUM OXIDES/crystallization; VANADIUM OXIDES/phase diagrams; BISMUTH OXIDES; CALCIUM OXIDES; CRYSTAL GROWTH; FERRITE GARNETS; CRYSTALLIZATION; IRON OXIDES; LEAD OXIDES; MOLTEN SALTS; MONOCRYSTALS; VERY HIGH TEMPERATURE

5591 (INIS-SU–129, pp. 236-238) **Growth and investigation of crystals of beryl varieties.** Radionov, A.Ya. (AN SSSR, Novosibirsk (USSR). Inst. Geologii i Geofiziki); Rylov, G.M.; Solntsev, V.P.; Khranenko, G.G.; Maslov, V.A.; Mikhajlov, M.A. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2.*

Extended theses. Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 2 refs.; 2 figs. BERYLLIUM SILICATES/crystal growth; ALUMINATES; BERYL; CRYSTAL STRUCTURE; CRYSTALLIZATION; INCLUSIONS; KINETICS; METALLURGICAL FLUX; MOLTEN SALTS; MONOCRYSTALS; PHASE STUDIES; PHYSICAL PROPERTIES; VERY HIGH TEMPERATURE

5592 (INIS-SU–129, pp. 239-240) **Theoretical and experimental principles of new crystals search in solution-melt media.** Timofeeva, V.A. (AN SSSR, Moscow (USSR). Inst. Kristallografii). AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 4 refs.; 1 fig.; 1 tab. INDIUM COMPOUNDS/crystal growth; RARE EARTH COMPOUNDS/crystal growth; SCANDIUM COMPOUNDS/crystal growth; YTTRIUM SILICATES/crystal growth; CHEMICAL COMPOSITION; GERMANATES; KINETICS; MOLTEN SALTS; SODIUM SILICATES; SPACE GROUPS

5593 (INIS-SU–129, pp. 241-242) **Crystallization of orthosilicates of beryllium, magnesium, iron, nickel, and manganese from solution-melt media.** Tolstykh, O.N. (AN SSSR, Novosibirsk (USSR). Inst. Geologii i Geofiziki); Ripinen, O.I. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 2 figs. BERYLLIUM SILICATES/crystal growth; BERYLLIUM SILICATES/solubility; MOLTEN SALTS/solubility; MOLYBDATES/molten salts; TUNGSTATES/molten salts; VANADATES/molten salts; SOLUBILITY; COLOR; CRYSTALLIZATION; KINETICS; METALLURGICAL FLUX; MOLYBDATES; PHYSICAL PROPERTIES; TEMPERATURE DEPENDENCE; TUNGSTATES; VANADATES; VERY HIGH TEMPERATURE

5594 (INIS-SU–129, pp. 270-271) **Effect of substrate orientation on the processes of epitaxy layers growth and formation of transitional areas in the InGaAsP(InP) and InGaAsP(GaAs) systems.** Amus'ya, V.M. (AN SSSR, Leningrad (USSR). Fiziko-Tekhnicheskij Inst.); Arsent'ev, I.A.; Bert, N.A. and others. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 2 refs. INDIUM ARSENIDES/epitaxy; INDIUM PHOSPHIDES/epitaxy; GALLIUM ARSENIDES; GALLIUM PHOSPHIDES; EPITAXY; KINETICS; LAYERS; ORIENTATION; SOLID SOLUTIONS; SUBSTRATES; THICKNESS

5595 (INIS-SU–129, pp. 279-280) **Regularities of liquid epitaxy of isoperiodic structures $Ga_{1-x}In_xSb_{1-y}As_y$/GaSb ($x \leq 0{,}24$).** Baranov, A.N. (AN SSSR, Leningrad (USSR). Fiziko-Tekhnicheskij Inst.); Gussejnov, A.A.; Dzhurtanov, B.E.; Mirsagatov, M.A.; Faleev, N.N.; Cherneva, T.V.; Yakovlev, Yu.P. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: 7. All-Union conference on crystal growth; Symposium on molecular beam epitaxy, Moscow (USSR); Moscow (USSR), 14 Nov 1988; 14 nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 3 refs.; 1 fig. INDIUM ARSENIDES/epitaxy; INDIUM ARSENIDES/solid solutions; ANTIMONIDES; CHEMICAL COMPOSITION; GALLIUM ARSENIDES; EPITAXY; LATTICE PARAMETERS; ORIENTATION; QUANTITY RATIO; SUBSTRATES

5596 (INIS-SU–129, pp. 281-282) **Liquid epitaxy of solid solutions $In_xGa_{1-x}As_ySb_{1-y}$ isoperiodic to GaSb (x and y >0,7).** Baranov, A.N. (Leningradskij Ehlektrotekhnicheskij Inst., Leningrad (USSR)); Kachalova, I.A.; Kuznetsov, V.V.; Cherneva, T.V.; Sherstnev, V.V. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. INDIUM ARSENIDES/epitaxy; INDIUM ARSENIDES/solid solutions; ANTIMONIDES; CHEMICAL COMPOSITION; GALLIUM ARSENIDES; EPITAXY; LATTICE PARAMETERS; PHASE STUDIES

5597 (INIS-SU–129, pp. 285-286) **Peculiarities of crystallization of $Ga_xIn_{1-x}As_yP_{1-y}$/InP and $In_{1-x}Ga_xAs$/InP thim films from liquid phase containing rare earths.** Bezhan, N.P. (Kishinevskij Politekhnicheskij Inst., Kishinev (USSR)); Lyakhu, G.L.; Petrov, A.I.; Snigur, A.P.; Chumak, V.A.; Shul'ga, A.I. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 1 tab. INDIUM ARSENIDES/epitaxy; INDIUM ARSENIDES/thin films; INDIUM PHOSPHIDES/epitaxy; INDIUM PHOSPHIDES/thin films; CARRIER MOBILITY; CHARGE CARRIERS; ELECTRIC CONDUCTIVITY; GALLIUM ARSENIDES; GALLIUM PHOSPHIDES; HIGH TEMPERATURE; EPITAXY; PHOTOLUMINESCENCE; QUANTITY RATIO; SUBSTRATES; YTTRIUM ADDITIONS

5598 (INIS-SU–129, pp. 307-308) **Investigation of phase equilibria in the In-Ga-P-As system.** Ermakov, O.N. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 4 refs.; 1 fig. INDIUM ARSENIDES/epitaxy; INDIUM ARSENIDES/phase studies; INDIUM PHOSPHIDES/epitaxy; INDIUM PHOSPHIDES/phase studies; CHEMICAL COMPOSITION; EQUILIBRIUM; GALLIUM ARSENIDES; GALLIUM PHOSPHIDES; EPITAXY; OPTICAL PROPERTIES; SEGREGATION; SOLID SOLUTIONS; VERY HIGH TEMPERATURE

5599 (INIS-SU–129, pp. 312-313) **Investigation of growth kinetics of varizone epitaxial layers of $Pb_{1-x}Sn_xTe$.** Zhovnir, G.I. (Kirovogradskij Gosudarstvennyj Pedagogicheskij Inst., Kirovograd (Ukrainian SSR)); Kletskij, S.V.; Tsarenko, O.N. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 2 refs.; 1 fig. LEAD TELLURIDES/epitaxy; TIN TELLURIDES/epitaxy; CHEMICAL COMPOSITION; KINETICS; EPITAXY; MATHEMATICAL MODELS; PHASE STUDIES; QUANTITY RATIO; SPATIAL DISTRIBUTION; SUBSTRATES

5600 (INIS-SU–129, pp. 314-315) **Structure perfection of epitaxial layers of indium phosphide and solid solutions on its basis depending on the method of their growth.** Zenkovich, T.A. (AN Moldavskoj SSR, Kishinev (USSR). Inst. Prikladnoj Fiziki);

Maronchuk, Eh.E.; Smirnov, V.G. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 1 fig. INDIUM ARSENIDES/crystal structure; INDIUM ARSENIDES/epitaxy; INDIUM PHOSPHIDES/crystal structure; INDIUM PHOSPHIDES/epitaxy; GALLIUM ARSENIDES; HIGH TEMPERATURE; EPITAXY; MEDIUM TEMPERATURE; MICROHARDNESS; SEMICONDUCTOR MATERIALS; SOLID SOLUTIONS; SUBSTRATES; TEMPERATURE DEPENDENCE

5601 (INIS-SU–129, pp. 316-318) **Distribution of composition in epitaxial layers of $Mn_xHg_{1-x}Te$.** Ivanov-Omskij, V.I. (AN SSSR, Leningrad (USSR). Fiziko-Tekhnicheskij Inst.); Mironov, K.E.; Movileh, V.F.; Koriyakova, O.V. AN SSSR, Moscow (USSR); Ministerstvo Khimicheskoj Promyshlennosti SSSR, Moscow (USSR). 1988. (In Russian). (CONF-8811251–: Symposium on molecular beam epitaxy, Moscow (USSR), 14 Nov 1988; CONF-8811252–). In *Crystal growth from solutions. Growth of monocrystals and films of high-temperature superconductors. V. 2. Extended theses.* Order Number DE90705921. Available from NTIS (US Sales Only), PC A20/MF A01 - OSTI; INIS.

Short note. 1 ref.; 2 figs. CADMIUM TELLURIDES/epitaxy; MANGANESE TELLURIDES/epitaxy; MERCURY TELLURIDES/epitaxy; EPITAXY; CHEMICAL COMPOSITION; DISLOCATIONS; LAYERS; PHASE STUDIES; SOLID SOLUTIONS; SPATIAL DISTRIBUTION; SUBSTRATES; THICKNESS

5602 (IPP–III/149) **Electrochemical 'cold fusion' trials at IPP Garching.** Bosch, H.S. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)); Gernhardt, J.; Karger, F.; Perchermeier, J.; Wurden, G.A. Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.). Jul 1989. 45p. Order Number DE90729144. Available from NTIS (US Sales Only), PC A03/MF A01.

Following the report of Fleischmann and Pons, we (The Bavarian Bubble Bottle Team) have attempted to reproduce their claims of cold nuclear fusion, and failed. We note that our measurements would not be able to detect neutrons at the level of Jones et al. Three electrolytic cell experiments were conducted using palladium cathodes and Platinum anodes, in a 0.1 Molar solution of LiD in heavy water, without any signs of neutrons, tritium or gammas above backgrounds, and within +-0.3 Watt accuracy calorimetry, no excess heating. Excess heating at the levels of F^P would have been easily detected, if present. Intrinsic tritium, differing from each D_2O bottle tested, was however observed. The longest duration experiment ran for 21 days, and was an attempt to duplicate the large 'melting incident' of F^P. This was terminated on April 28, 1989, by throwing the vacuum-cast 22 gram, deuterium-loaded palladium cathode directly into liquid nitrogen, immediately next to a bare BF_3 counter (backed by 25 cm of moderator), in order to attempt one of the Italian ENEA neutron production variants. No neutrons above backgrounds were seen, while counting for one hour, and also none while the piece warmed to room temperature over the next hour. Post mortem analysis of the darkened, hardened Pd piece showed large crystal grains (up to 2 mmx2 mm), and continuing evolution of gas bubbles at the grain boundaries even four days after the experiment was ended. Eight weeks after loading, the catalytically active palladium piece continued to create heavy water (with exposure to oxygen in the air). (orig.).

5603 (PB–89-873954/XAB) **Chemical and biological warfare: Biology, chemistry, and toxicology. May 1988-October 1989 (Citations from the NTIS data base). Report for May 1988-October 1989.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 165p. Available from NTISPC N01/MF N01.

Supersedes PB–89-859300.

This bibliography contains citations concerning the toxicology of chemical and biological agents; general biological and medical studies; and the properties, synthesis, and reactions of chemical agents and related compounds. Other published searches in this series cover detection and warning, defoliants, protection, general studies, and biochemistry and therapy of chemical agents. (This updated bibliography contains 248 citations, 114 of which are new entries to the previous edition.)

5604 (RISO-M–2791) **Iodine in the environment revisited: An evaluation of the chemical- and physico chemical processes possibly controlling the migration behaviour of iodine in the terrestrial environment.** Christiansen, J.V.; Carlsen, L. Risoe National Lab., Roskilde (Denmark). May 1989. 39p. Order Number DE90610742. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The report gives an overview of the environmental cycle of iodine, especially focusing on the possible reactions being responsible for the retention of iodine in the terrestrial environment. During the last two decades evidence for the presence of iodine in soil as organically bound has been presented. The major part of inorganic iodine in the terrestrial environment will, under physical and chemical conditions normally prevailing, exist as iodide. No evidence for a direct reaction between iodide and organic material has been presented, whereas strong support for the engagement of microbial activity in the formation of organic iodine compounds in soil has been obtained. Incorporation of iodine in humic substances as a result of enzymatic catalysis, involving an enzyme of the perozidase group apperas reasonable. It is concluded that microbiological activity involving extracellular enzymes most probably is responsible for the possible retention of iodine in the terrestrial environment. It is suggested that these reactions in detail should be studied experimentally. (author) 3 tabs., 2 ills., 51 refs.

5605 (UCID–21755) **The effect of precipitation conditions and aging upon characteristics of particles precipitated from aqueous solutions.** Rard, J.A. Lawrence Livermore National Lab., CA (USA). Oct 1989. 18p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90004441. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Precipitation of a dissolved species from aqueous solutions is one of the techniques used to grow particles with certain size or composition characteristics. Various factors affecting the particle properties for sparingly soluble substances are briefly discussed here, including homogeneous versus heterogeneous nucleation, the effect of relative supersaturation on the number of nuclei and their relative size, particle growth by way of Ostwald Ripening, the Ostwald Step Rule and nucleation of metastable phases, diffusion-controlled versus surface reaction-controlled growth, incorporation of dopants into the precipitate, and dendritic growth. 13 refs.

5606 **A solvent anode for plutonium purification.** Bowersox, D.F. (Los Alamos National Lab., Los Alamos, NM (US)); Fife, K.W.; Christensen, D.C. pp. 469 of Chemical separations. King, C.J.; Navratil, J.D. Litarvin Literature, Arvada, CO (1986). (CONF-860411–: 1. international conference on separations science and technology, New York, NY (USA), 15-17 Apr 1986).

The purpose of this study is to develop a technique to allow complete oxidation of plutonium from the anode during plutonium electrorefining. This will eliminate the generation of a spent anode heel which requires further treatment for recovery. The authors' approach is to employ a solvent metal in the anode to provide a liquid anode pool throughout electrorefining. They use molten salts and metals in ceramic crucibles at 700°C. The goal is to produce plutonium metal at 99.9% purity with oxidation and transfer of more than 98% of the impure plutonium feed metal from the anode into the salt and product phases. They have met these criteria in experiments on the 100-1000g scale. The authors plan to scale their operations to 4 kg of feed plutonium and to optimize the process parameters.

5607 **Americium removal from nitric acid waste streams.** Muscatello, A.C. (Rockwell International, Rocky Flats Plant, PO Box 464, Golden, CO (US)); Navratil, J.D. pp. 469 of Chemical separations. King, C.J.; Navratil, J.D. Litarvin Literature, Arvada, CO (1986). DOE Contract AC04-76DP03533. (CONF-860411–: 1. international conference on separations science and technology, New York, NY (USA), 15-17 Apr 1986).

Separations research at the Rocky Flats Plant (RFP) has found ways to significantly improve americium removal from nitric acid (7M) waste streams generated by plutonium purification operations. Partial neutralization of the acid waste followed by solid supported

liquid membranes (SLM) are useful in transferring and concentrating americium from nitrate solutions. Specifically, DHDECMP (dihexyl-N,N-diethylcarbamoylmethylphosphonate) supported on Accurel polypropylene hollow fibers assembled in modular form transfers >95% of the americium from high nitrate (6.9M), low acid (0.1M) feeds into 0.25M oxalic acid stripping solution. Maximum permeabilities were observed to be 0.001 cm/sec, consistent with typical values for other systems. The feed:strip volume ratio shows an inverse relationship to the fraction of metal ion transferred. Cation exchangers may be used to concentrate americium from the strip solution.

4004 Electrochemistry

Refer also to citation(s) 5228, 5292, 5293, 5458

4005 Photochemistry

Refer also to citation(s) 5539, 5565, 5701, 5702, 5787, 5790, 6020

5608 (CONF-891252–1) **Nonresonant and resonant multiphoton ionization of $(NO)_n$ and Ar_nNO clusters with picosecond laser pulses.** Smith, D.B.; Miller, J.C. Oak Ridge National Lab., TN (USA). [1989]. 24p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Faraday symposium: the Royal Society of Chemistry; London (UK); 12-14 Dec 1989. Order Number DE89016853. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

High-peak-power laser pulses have been used to effect multiphoton ionization (MPI) in supersonic nozzle expansions of nitric oxide in argon. The $(NO)_{n\leq 5}$ clusters have been detected for the first time by a multiphoton laser technique. The Ar_2 and $Ar_{n<7}NO$ complexes were also observed. Results from a number of different visible and ultraviolet wavelengths are compared and interpreted with reference to the known electronic states of $(NO)_n$ and $(NO)_n^*$. When resonant with the dissociative B_1 state of $(NO)_2$ at ~ 217 nm, cluster ions are observed with picosecond but not with nanosecond laser pulses. In contrast, nonresonant MPI at certain wavelengths results in parent cluster ions with either nanosecond or picosecond lasers. The use of such high-peak power lasers for the characterization of cluster beams is discussed and compared with more conventional electron impact techniques. 49 refs., 4 figs., 2 tabs.

4006 Radiation Chemistry

5609 **Radiolysis of water.** Burns, W.G. (UKAEA Harwell Lab. (UK). Chemistry Div.). *Nature (London) (UK)*, 339(6225): 515-516 (15 Jun 1989).

Letter to the Editor.

4007 Radiochemistry and Nuclear Chemistry

Refer also to citation(s) 4755, 4893, 4894, 4897

5610 (IAEA-TECDOC–515, pp. 23-33) **Operation of the installation for fission ^{99}Mo production in Argentina.** Marques, R.O. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Direccion de Radioisotopos y Radiaciones); Cristini, P.R.; Fernandez, H.; Marziale, D. International Atomic Energy Agency, Vienna (Austria). Jun 1989. (CONF-8710503–: Technical committee on fission molybdenum for medical use, Karlsruhe (Germany, F.R.), 13-16 Oct 1987). In *Fission molybdenum for medical use. Proceedings of a technical committee meeting held in Karlsruhe, 13-16 October 1987.* Order Number DE90608568. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

The paper describes the efforts of the Argentine Atomic Energy Commission to establish a programme to produce fission ^{99}Mo for the preparation of ^{99m}Tc generators. The production plant has been completed in 1987 and has started limited production runs. The hot cells consist of four hot cells with a stainless steel lining. The chemical separation process of ^{99}Mo from the irradiated Al/Alloy (90% enriched) targets is similar to the process developed by A. Sameh in the Federal Republic of Germany. The product specification conforms very well with the requirements for a safe use in the preparation of ^{99m}Tc generator for medical use. (author). 3 figs.

5611 (IAEA-TECDOC–515, pp. 35-46) **Development of the ^{99}Mo process at CRNL.** Burrill, K.A. (Atomic Energy of Canada Ltd., Chalk River, ON (Canada). Chalk River Nuclear Labs.); Harrison, R.J. International Atomic Energy Agency, Vienna (Austria). Jun 1989. (CONF-8710503–: Technical committee on fission molybdenum for medical use, Karlsruhe (Germany, F.R.), 13-16 Oct 1987). In *Fission molybdenum for medical use. Proceedings of a technical committee meeting held in Karlsruhe, 13-16 October 1987.* Order Number DE90608568. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

Highly enriched uranium (HEU) is used for Mo-99 production at CRNL. Dissolution of the targets and loading of the solution onto Al_2O_3 columns is discussed. Development work continues to reduce processing time and overall product cost. A process for treating the fission product waste has been selected and a facility for processing is being designed. Low enriched uranium (LEU) is planned for targets eventually. Our experience with Si-based fuel for targets is poor, and alternatives are being sought. (author). 1 ref., 7 figs.

5612 (IAEA-TECDOC–515, pp. 149-154) **Reprocessing of irradiated ^{235}U for the production of ^{99}Mo, ^{131}I and ^{133}Xe radioisotopes.** Salacz, J. (Institut National des Radioelements, Brussels (Belgium)). International Atomic Energy Agency, Vienna (Austria). Jun 1989. (CONF-8710503–: Technical committee on fission molybdenum for medical use, Karlsruhe (Germany, F.R.), 13-16 Oct 1987). In *Fission molybdenum for medical use. Proceedings of a technical committee meeting held in Karlsruhe, 13-16 October 1987.* Order Number DE90608568. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

The plant reprocessing irradiated Uranium-235 uses 6 hot cells and two shielded boxes. After removing the targets from the transport container, adapted to the special hot-cell door, the reprocessing follows the different steps, dissolution of targets, filtration, acidification, purification on alumina, dowex and activated carbon columns. The routine performance of the facility is indicated as well as the radionuclidic purity as for the operation yields. Depending on the reactor used, the obtained Mo-99 activity varies from 12 TBq to 19 TBq post calibrated 8 days after unloading 6 targets from the reactor. Complementary, more than 20 TBq Xe-133 and 5 TBq I-131 at the same calibration date are recuperated by side-processes developed into shielded boxes (Xe-133) and a special hot cell (I-131). This paper is reproduced under the explicit authorization of the Director General of the Institut National des Radioelements. (author). 6 refs, 4 figs, 1 tab.

5613 (INIS-mf–11544, pp. 85-106) **Blood cells radiolabelling achievements, challanges, and prospects.** Weininger, Jolie (Israel Atomic Energy Commission, Yavne (Israel). Soreq Nuclear Research Center); Trumper, Jacob. Comision Nacional de Energia Atomica, Buenos Aires (Argentina). 1987. (CONF-8610464–: 5. international symposium on radiopharmacology, Buenos Aires (Argentina), 29-31 Oct 1986). In *Progress in radiopharmacology. Proceeding of the fifth international symposium on radiopharmacology held at Buenos Aires, October 29, 30 and 31, 1986.* Order Number DE90705934. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

A study in performed about the different ways of blood cells radiolabelling. The labelling of red blood cells (RBCs), compared with that of other blood cells, is facilitated by several factors such as (a) RBCs are the most abundant of all cellular blood elements,(b) they are relatively easy to separate and manipulate in vitro, (c) in vitro they are less dependent on energy and nutricional requirements, (d) they are easy to label due to the presence of a variety of cellular transport mechanism. ^{99m}Tc was reconized and became as the ideal radioisotope for nuclear medicine imaging. After considerations about RBCs radiolabelling, it is presented a new in vitro technique based on the BNL kit, developed by Srivastava and co-workers. The Sorep optimized one-vial labelling method for 2 ml whole blood. In vivo and in vivo/in vitro labelling are presented too, the last method seems to combine the superior binding efficiency of in vitro labelling with the convenience of in vitro labelling. Lipophilic chelates of ^{111}In with oxine, acetylacetone, tropolone and mercaptopyridine N-oxide have been used successfully for labelling platelets and leukocytes. A very promising aproach is the labelling of cells with monoclonal antibodies and the developing optimized

methods for in vitro labelling with various radionuclides such as ^{123}I, ^{125}I, ^{131}I, ^{111}I and ^{99m}Tc. The advantages of the antibody technique over conventional cell labelling are shown. (M.E.L.).

5614 (INIS-mf–11562, pp. 74) **Radionuclide purity of supplies of injectable sodium (^{99m}Tc)pertechnetate from ^{99}Mo-^{99m}Tc extraction generator at UJV Rez in comparison with foreign products.** Silar, J. (Karlova Univ., Prague (Czechoslovakia). Biofyzikalni Ustav); Prokop, J. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. RADIOPHARMACEUTICALS/ radioisotope generators; TECHNETIUM 99/isotope ratio; IMPURITIES; IODINE 131; MOLYBDENUM 99; PERTECHNETATES; RADIOPHARMACEUTICALS; RHENIUM 188; TECHNETIUM COMPLEXES

5615 (INIS-mf–11562, pp. 75) **Determination of ^{99m}Tc activity in injectable sodium (^{99m}Tc)pertechnetate from ^{99}Mo-^{99m}Tc extraction generator at UJV Rez.** Silar, J. (Karlova Univ., Prague (Czechoslovakia). Biofyzikalni Ustav); Budsky, F. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. RADIOPHARMACEUTICALS/ radioactivity; TECHNETIUM 99/radioactivity; PERTECHNETATES; RADIOISOTOPE GENERATORS; RADIOPHARMACEUTICALS; RADIOACTIVITY; TECHNETIUM COMPLEXES

5616 (INIS-mf–11562, pp. 76) **Radionuclide purity of radiopharmaceuticals most commonly used by nuclear medicine department of Medical Faculty, Charles University in Prague.** Silar, J. (Karlova Univ., Prague (Czechoslovakia). Biofyzikalni Ustav). Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. RADIOPHARMACEUTICALS/ impurities; BETA SPECTROSCOPY; ISOTOPE RATIO; RADIOISOTOPES; RADIOPHARMACEUTICALS; IMPURITIES

4008 Combustion, Pyrolysis, and High-Temperature Chemistry

Refer also to citation(s) 5381, 5395

5617 (DOE/ER/13224–11) **Kinetic measurements on elementary fossil fuel combustion reactions over wide temperature ranges: Progress report, December 1, 1986–October 31, 1989.** Fontijn, A. Rensselaer Polytechnic Inst., Troy, NY (USA). High-Temperature Reaction Kinetics Lab. Nov 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-84ER13224. Order Number DE90003178. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Results from kinetic studies over wide temperatures ranges of the reactions of oxygen atoms with H_2, D_2, ethylene, acetylene, ethane, propylene, and HCl are reported, as are plans and preliminary results on the O- and H-atom reactions with benzene. 5 refs.

5618 (PB–89-237119/XAB) **Influence of droplet spacing on drag coefficient in nonevaporating, monodisperse streams.** Mulholland, J.A.; Srivastava, R.K.; Wendt, J.O.L. Acurex Corp., Research Triangle Park, NC (USA). 1988. 8p. Available from NTIS, PC A02/MF A01.

Pub. in AIAA (American Institute of Aeronautics and Astronautics, Inc.) Jnl., Vol. 26, No. 10, 1231-1237(Oct 1988).

It is well established that droplet interactions profoundly influence the ignition and combustion behavior of droplet clouds and fuel sprays. Four-group combustion modes of a droplet cloud have been identified, with that of single-droplet combustion possibly being applicable in practice to only a very limited number of special situations. Such a special situation, however, can arise during the incineration of liquid hazardous wastes, where droplets with large diameters congregate at the outer edge of fuel-spray cones. One or more of these stray droplets then may individually pass through, or bypass, the main flame zone and lead to a failure mode in the incinerator. In this document, the influence of droplet spacing on the drag coefficient of individual drops injected into a quiescent environment has been determined through measurement of trajectories of single, monodisperse, nonevaporating droplet streams.

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4202 Facilities, Equipment, and Techniques

Refer also to citation(s) 4705, 4756, 4765, 4960, 4975, 5120, 5485, 5486, 5556, 5650, 5817, 6351, 6352, 6419

5619 (AD-A–211509/5/XAB) **Kapitza conductance of crystals cleaved under He II.** Eckels, P.W.; Parker, J.H.; Patterson, A. Westinghouse Electric Corp., Pittsburgh, PA (USA). Research Labs. Jul 1986. 5p. Available from NTIS, PC A02/MF A01.

Pub. in Cryogenics, Vol. 26, 427-430(Jul 1986).

The Kapitza conductance of LiF and KBr single crystals has been measured immediately after cleaving under superfluid helium. Heating techniques were used to evaluate the conductance and it approached the phonon radiation limit for these materials. Cleaving LiF under He II reduced the Kapitza conductance compared to an aged, cleaved surface by only a few percent. Despite the very good cleaved surface obtained with LiF crystals, the results suggest that sufficient microfracturing of the surface occurs upon cleaving to significantly increase the Kapitza conductance over the acoustic mismatch theory values. These results are in contradiction to results obtained by phonon reflection techniques.

5620 (AD-A–211580/6/XAB) **Superconducting-switch program. Final interim report, January 1987-April 1988.** Francavilla, T.L.; Wolf, S.A.; Gubser, D.U. Naval Research Lab., Washington, DC (USA). 22 Aug 1989. 21p. (NRL-MR–6508). Available from NTIS, PC A03/MF A01.

This is the final report of work done to study the feasibility of a superconducting opening switch. This phase of the investigation considers the following: (1) The achievement of critical current densities of over 10^7 power A/sq cm in NbN. (2) Determination of the power required to operate a superconducting switch. (3) Utilization of materials other than NbN in such a switch.

5621 (AD-A–211607/7/XAB) **SIs (superconductor-insulator-superconductor) mixer research. Final technical report, November 1987-November 1988.** Feldman, M.J. Virginia Univ., Charlottesville, VA (USA). Dept. of Electrical Engineering. Jul 1989. 18p. (UVA–525659/EE90/101). Available from NTIS, PC A03/MF A01.

Theoretical and experimental research was conducted to elucidate the basic physics behind the properties of superconductor-insulator-superconductor (SIS) tunnel-junction receiving devices. The saturation behavior of the SIS mixer and the SIS direct detector was calculated. The direct detector was found to saturate at far higher powers than previously believed, allowing the possibility of practical application. SIS mixer saturation was measured using both

monochromatic and thermal signals, and these experiments dramatically verified the theoretical expression. Quantum noise in the quantum theory of mixing was identified as the residual remaining when the usual noise sources are minimized. The quantum noise limit was shown to be reached in only two special cases. Computer calculations determined that the behavior of SIS receivers divides into two frequencies regimes, the cross-over frequency depending upon junction quality. The properties of these two regimes were delineated. A study of the role of the image termination of SIS mixers found that the nonlinear quantum reactance results in an effective time delay at the input port. Many aspects of the operation of SIS mixers at submillimeter wavelengths were clarified. Niobium nitride edge junctions with excellent current-voltage characteristics were fabricated using a novel barrier-formation process.

5622 (AEEW-M–2507-Issue2) **Large transport packages for decommissioning waste. Semi-annual report for period 1 July - 31 December 1987.** Price, M.S.T. (ed.). UKAEA Atomic Energy Establishment, Winfrith (UK). Materials Technology Div. Mar 1988. 61p. Order Number DE90608624. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

The main tasks performed during the period related to the influence of manufacture, transport and disposal on the design of such packages. It is deduced that decommissioning wastes will be transported under the IAEA Transport Regulations under either the Type B or Low Specific Activity (LSA) categories. If the LSA packages are self-shielded, reinforced concrete is the preferred material of construction. But the high cost of disposal implies that there is a strong reason to investigate the use of returnable shields for LSA packages and in such cases they are likely to be made of ferrous metal. Economic considerations favour the use of spheroidal graphite cast iron for this purpose. Transport operating hazards have been investigated using a mixture of desk studies, routes surveys and operations data from the railway organisations. Reference routes were chosen in the Federal Republic of Germany, France and the United Kingdom. This work has led to a description of ten accident scenarios and an evaluation of the associated accident probabilities. The effect of disposal on design of packages has been assessed in terms of the radiological impact of decommissioning wastes, an in addition corrosion and gas evolution have been examined. The inventory of radionuclides in a decommissioning waste package has low environmental impact. If metal clad reinforced concrete packages are to be used, the amount of gas evolution is such that a vent would need to be included in the design. Similar unclad packages would be sufficiently permeable to gases to prevent a pressure build-up. (author).

5623 (CEGB-RD/M–1743/RR88) **Multilink manipulator computer control: experience in development and commissioning.** Holt, J.E. Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs. Nov 1988. 17p. Order Number DE90610082. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This report describes development which has been carried out on the multilink manipulator computer control system. The system allows the manipulator to be driven using only two joysticks. The leading link is controlled and the other links follow its path into the reactor, thus avoiding any potential obstacles. The system has been fully commissioned and used with the Sizewell "A" reactor 2 Multilink T.V. manipulator. Experience of the use of the system is presented, together with recommendations for future improvements. (author).

5624 (CONF-891214–1) **Some numerical experiments concerning the equation of state algorithm for multi-material cells in HULL.** Burns, T.J. (Oak Ridge National Lab., TN (USA)). Oak Ridge National Lab., TN (USA). [1989]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From Hypervelocity impact symposium; San Antonio, TX (USA); 12-14 Dec 1989. Order Number DE89008240. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The solution of the partial differential equations of continuum mechanics as implemented in HULL requires that each mesh cell be well-characterized from a materials standpoint. Based on this viewpoint, the ideal situation is that each mesh cell consist of a single material, well-described by an Equation of State (EOS), Constitutive relations, etc. On the other hand, an Eulerian formulation is typically required to analyze hypervelocity impacts due to the very large deformations of both the projectile and target. The advection of materials and their associated properties from one mesh cell to another inherent in such a formulation however, inevitably leads to the creation of multi-material cells. Thus, one requirement for the use of the Eulerian formulation is that some provision for characterizing the multi-material cells via a single set of properties be implemented as a bridge between the two calculational modes. This procedure has been termed (for want of a better term) the Equation of State algorithm for multi-material cells, and is discussed in this paper.

5625 (CONF-8908186–1) **Electroplating simulation.** Gray, L.J. (Oak Ridge National Lab., TN (USA)); Giles, G.E.; Bullock, J.S.; McKenzie, P.W. Oak Ridge National Lab., TN (USA). [1989]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From European conference on mathematics in industry; Glasgow (UK); 28-31 Aug 1989. Order Number DE90003683. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A simulation of a three dimensional electroplating process which includes a model of the heat flow generated during the plating is presented. The steady state temperature distribution in the cell is coupled to the electric field through the nonlinear polarization (overvoltage) boundary conditions and the temperature dependence of the electrolyte conductivity. As the conductivity directly influences the deposition rate, variations due to temperature can have an impact on the shape of the plated part. The thermal and electrostatic problems are simultaneously solved using the boundary element method, and a simple iterative scheme is employed to satisfy the boundary conditions. A newly developed boundary element procedure for crack geometries is used to cope with the thin shielding present in the cell. Utilizing this technique, a computationally expensive and cumbersome multidomain decomposition of the region is avoided. 9 refs., 4 figs.

5626 (CONF-8911125–1) **Design and implementation of two concurrent multi-sensor integration algorithms for mobile robots.** Jones, J.P.; Beckerman, M.; Mann, R.C. Oak Ridge National Lab., TN (USA). [1989]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From SPIE symposium on advances in intelligent robotic systems; Philadelphia, PA (USA); 5-8 Nov 1989. Order Number DE90003041. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Two multi-sensor integration algorithms useful in mobile robotics applications are reviewed. A minimal set of utilities are then developed which enable implementation of these algorithms on a distributed memory concurrent computer. 14 refs., 3 figs.

5627 (ENEA-RT-COMB–89-07) **Rendering inert toxic and noxious wastes. Part two. Process based on methods for solidification of radioactive wastes in cement matrices.** Donato, A.; Arcuri, L.; Dotti, M.; Pace, A.; Pietrelli, L.; Ricci, G.; Basta, M.; Cali', V.; Pagliai, V. ENEA, Casaccia (Italy). Dipt. Ciclo del Combustibile; ENEA, Saluggia (Italy). Dipt. Ciclo del Combustibile. Jun 1989. 40p. (In Italian). Order Number DE90724608. Available from NTIS (US Sales Only), PC A03.

This paper reports the second part of a general study carried out at the Nuclear Fuel Division of the ENEA (Italian Commission for Alternative Energy Sources) Energy Research Center in Casaccia (Italy). It aims at verifying the possible application of radioactive waste solidification processes to industrial, toxic and noxious wastes (TNW). The cement solidification of several TNW types is taken into consideration, both from the technical and economic points of view. A short examination of the Italian juridical and economical situation in this field is made to demonstrate the need for TNW solidification. The origin and characteristics of the TNW samples, considered in this study and directly provided by the producing industries, are then reviewed. The laboratory experimental results of the cementation of wastes produced by gold manufacturing industries and by galvanizing industries are reported. The cementation process, is shown to be a very effective means for reducing both TNW management costs and the environmental impact.

5628 (ENEA-RT-COMB–89-10) **Rendering inert toxic and noxious wastes. Part one. Process based on methods for solidification of radioactive wastes in polymer matrices.** Donato, A.;

Arcuri, L.; Dotti, M.; Pace, A.; Ricci, G.; Salluzzo, A.; Altamura, V.; Cornacchia, G.; De Vincenzis, G.; Siepe, V. ENEA, Casaccia (Italy). Dipt. Ciclo del Combustibile; ENEA, Trisaia (Italy). Dipt. Ciclo del Combustibile. Jun 1989. 51p. (In Italian). Order Number DE90724607. Available from NTIS (US Sales Only), PC A04/MF A01.

This paper reports the first part of a general study carried out at the Nuclear Fuel Division of the ENEA (Italian Commission for Alternative Energy Sources) Energy Research Center in Casaccia, Italy. It aims at verifying the possible application of radioactive waste solidification processes to industrial, toxic and noxious wastes (TNW). The incorporation, in polymer matrices, of several TNW types is taken into consideration, both from the technical and economic points of view. A short examination of the Italian juridical and economical situation in this field is made to demonstrate the need for TNW solidification. The origin and characteristics of the TNW samples considered in this study and directly provided by the producing industries, are then reviewed. The laboratory experimental results of TNW solidification in polyester and urea-formaldehyde resins are reported and discussed. While the characteristics of the solidified products generally comply with the established requirements, the overall process costs appear to be relatively high.

5629 (ETDE-IT–89-30) **Turbine blades vibrations analysis: Use of holographic interferometry.** Casamatta, V.; Cocilovo, V.; Gagliardi, F.; Imperiali, F. ENEA, Casaccia (Italy). Centro Ricerche Energia. Dec 1987. 30p. (In Italian). Order Number DE90724615. Available from NTIS (US Sales Only), PC A03/MF A01.

Relevant to power plant components, this paper deals with the non-destructive testing of turbine blades by the use of holographic interferometry. Test activities and vibrations analysis results are reported. Suggestions are made for the application of this testing technique in other sectors of industry.

5630 (IAEA-TECDOC–513, pp. 29-37) **Research reactor fuel handling.** Kritzkij, V.G. (All-Union Project and Research Inst. of Complex Power Technology, Leningrad (USSR)); Mikhailov, G.V.; Tikhonov, N.S.; Makarchuk, T.F.; Ivanov, V.I. International Atomic Energy Agency, Vienna (Austria). Sep 1989. (CONF-8811290–: Technical committee on the safe management of spent fuel from research reactors, prototype power reactors and fuel from commercial power reactors that has been subjected to post-irradiation examinatio, Vienna (Austria), 28 Nov - 1 dec 198 In *Management of spent fuel from research and prototype power reactors and residues from post-irradiation examination of fuel. Proceedings of a technical committee meeting held in Vienna, 28 November - 1 December 1988.* Order Number DE90610069. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

Some research reactors are sited within the city boundaries, therefore the required safety for the public must be guaranteed in the reactor operation, spent fuel shipping and storing. The ecological safety of spent fuel storage is achieved by the integrity of fuel element claddings and by the system maintaining the pool water chemistry. In the USSR a cask-19 for research and experimental reactor spent fuel assemblies transport has been developed. It is a thick-walled vessel tightly covered with a heavy cap. The cask allows the shipment of spent fuel assemblies of different research reactors with various FA section shapes and with the total decay heat of up to 360W. The cask design assures nuclear safety, biological shielding, heat removal from fuel assemblies, tightness, strength in normal and emergency conditions of transportation. (author). 3 refs, 2 figs, 4 tabs.

5631 (LA-UR–89-1834) **Aspects of blast resistant masonry design.** Volkman, D.E. Los Alamos National Lab., NM (USA). [1989]. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-891223–1: American Society for Testing and Materials conference, Orlando, FL (USA), 5 Dec 1989). Order Number DE89012631. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Blast resistant design should be examined for building code incorporation, due to the potential of explosions occurring in an industrial society. Specifically, public and commercial structures of concrete masonry construction need additional building code criteria, since these buildings have high density populations to protect. Presently, blast resistant design is accomplished by using government published manuals, but these do not address industry standard construction. A design air blast load of 4.54 kg (10 lbs) of TNT, located 0.91 m (3 ft) above ground surface and 30.48 m (100 ft) from a structure should be considered standard criteria. This loading would be sufficient to protect against blast, resist progressive failure, and yet not be an economic impediment. Design details and adequate inspection must be observed to ensure blast resistant integrity. 10 refs., 3 figs., 1 tab.

5632 (LA-UR–89-2309) **Hydrodynamics code calculations of debris clouds produced by ball-plate impacts.** Holian, K.S. (Los Alamos National Lab., NM (USA)). Los Alamos National Lab., NM (USA). [1989]. 30p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-891214–4: Hypervelocity impact symposium, San Antonio, TX (USA), 12-14 Dec 1989). Order Number DE89015270. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

When a metal projectile hits a thin metal plate at a high enough velocity to penetrate it, a cloud of debris is produced, whose structure for normal impacts provides a unique test for hydrodynamic computer simulation. Since the equations of state of the materials involved are a vital ingrediant for hydrocode calculations, we would like to determine how important it is to use an accurate equation of state. This paper reports results of benchmark calculations of hypervelocity impacts of a lead sphere on a lead plate where significant vaporization occurs. The results are somewhat sensitive to the equation of state used, particularly in the regime where the material is expanded. The results are greatly affected when an attempt is made to include nonequilibrium effects by allowing negative pressures in the EOS. 23 refs., 6 figs.

5633 (LA-UR–89-2342) **MESA 3-D calculations of armor penetration by projectiles with combined obliquity and yaw.** Cagliostro, D.J. (Los Alamos National Lab., NM (USA)); Mandell, D.A.; Schwalbe, L.A.; Adams, T.F.; Chapyak, E.J. Los Alamos National Lab., NM (USA). [1989]. 28p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-36. (CONF-891214–3: Hypervelocity impact symposium, San Antonio, TX (USA), 12-14 Dec 1989). Order Number DE89015265. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We introduce and briefly describe MESA, a new 3-D hydrodynamic code, developed specifically for simulations of armor and anti-armor systems. The code's current capabilities an its planned model improvements and additions are discussed. An Eulerian code using state-of-the-art numerical methods, MESA runs faster and is less affected by spurious numerical diffusion than older codes. It models hydrodynamic flow and the dynamic deformation of solid materials. It uses simple elastic-perfectly plastic material strength models as well as models with strain and strainrate hardening and thermal softening. Future versions will incorporate advanced fracture models. It treats detonations in explosives using a programmed burn. The code's current capabilities are illustrated with simulations of experiments on yawed rods obliquely impacting armor plates at 1.29 km/s. 12 refs., 14 figs.

5634 (LA-UR–89-2595) **Comparison of multidimensional calculations of long-rod impacts on oblique plates.** Fujita, R.K. (Los Alamos National Lab., NM (USA)); Cort, G.E. Los Alamos National Lab., NM (USA). 1989. 9p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-36. (CONF-891208–12: Winter annual meeting of the American Society of Mechanical Engineers, San Francisco, CA (USA), 10-15 Dec 1989). Order Number DE89015275. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The justification for three-dimensional versus two-dimensional simulations of non-symmetric armor penetration problems has been a topic of discussion for many years. Two-dimensional plane-strain approximations are generally not quantitatively accurate, especially at later times, but they can be performed efficiently and the results are usually acceptable. Although three-dimensional calculations provide better results, they are very time consuming and expensive to perform. But with the improved speed and memory capabilities of modern computers, it is now more feasible to perform three-dimensional calculations. In this study, we compare two- and three-dimensional Eulerian calculations performed with the HULL hydrodynamic computer code with experimental data from oblique

impacts of uranium-alloy penetrators into rolled homogeneous armor targets. The results of this study indicate that the three- dimensional calculations provide the best predictions of experimental data and are reasonably efficient to perform considering the improved accuracy of the calculation over comparable two-dimensional calculations. 2 refs., 8 figs., 2 tabs.

5635 (NBU/ME–TP8422E) **Tank thermal response analysis, phase 2: A study of the transient phenomena in a heated vessel during depressurization.** Wang, Q. (Univ. of New Brunswick, Fredericton, NB (Canada)); Venart, J.E.S. New Brunswick Univ., Fredericton, NB (Canada). Dept. of Mechanical Engineering. Dec 1987. 138p. (MICROLOG–89-04017). Available from PC Transport Canada, Library and Information Centre, Place de Ville, Tower C, Ottawa, ON, CAN K1A 0N5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This report presents the experimental results and analysis of a test series designed to evaluate the transient void fraction development in a partially filled, externally heated horizontal cylinder. The work was undertaken as part of a research program concerned with the safe transport of flammable pressure liquefied gases. Experiments were performed in an externally heated cylinder protected with a pressure relief valve. The change in liquid level and the flashing phenomena in the vessel were recorded by a video system. Selected time-dependent pressures, temperatures, as well as mass and bulk fluid plus boundary layer void fraction development were measured. Void fraction development and swell height measurements were compared to models which consider the transient behavior of the boiling boundary layer and the bulk fluid regions. Analytical and numerical solution procedures were developed to consider each region, presuming an initial linear temperature stratification in the liquid. In the region close to the liquid surface, the results of void fraction compare favorably with a model which ignores wall heat flux; however, lower within the bulk, void development is dependent upon the bottom wall heating. The computed transient mass loss compared with these models was greater than that measured, owing to the cyclic nature of the valve action. When the valve closed, fluid would be recompressed and condensation occurred. This was not accounted for in predicted by experimental analysis. 42 refs., 36 figs.

5636 (ND-R–1381(D)) **Guide to good practice: bagless transfer systems for use on radioactive facilities.** Lillyman, E. UKAEA Dounreay Nuclear Power Development Establishment (UK). Sep 1988. 53p. Order Number DE90610083. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

The development of the bagless posting system has improved the degree of safety possible during posting operations. It has provided the means of significantly reducing the large amounts of contaminated plastic waste created during bag posting and has provided the means of minimising personal exposure both in glovebox plutonium handling and in heavily shielded facilities. This report is intended to provide a guide to the types of bagless posting systems that are available both for glovebox and shielded facilities use. Included are references to developments which have utilised the bagless posting principle for sealing and utility change operations. Details of particular system types can be obtained from the identified design office or commercial organisation. (author).

5637 (NRC/ACP–89-03549) **Proceedings [of the] seventh NRCC [National Research Council of Canada] symposium on industrial application of gas turbines.** National Research Council of Canada, Ottawa, ON (Canada). Associate Committee on Propulsion. Sep 1987. 296p. (CONF-8709481–: 7. National Research Council of Canada (NRCC) symposium on industrial application of gas turbines, Banff (Canada), 27-30 Sep 1987; MICROLOG–89-03549). Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A symposium was held to examine various aspects of gas turbines used in industry, notably as gas compressors in pipelines. Papers were presented on maintenance and repair, new technologies such as oil-less bearings and computerized control systems, modifications to improve performance, and condition monitoring. Separate abstracts have been prepared for 15 papers from this symposium. 15 conf. papers

5638 (NRC/ACP–89-03549, pp. 37) **Improvements in the performance of a regenerative gas turbine with blade rejuvenation and modifications to the cooling and sealing systems.** Little, D. (Liburdi Engineering Ltd., Hamilton, ON (Canada)). National Research Council of Canada, Ottawa, ON (Canada). Associate Committee on Propulsion. Sep 1987. (CONF-8709481–: 7. National Research Council of Canada (NRCC) symposium on industrial application of gas turbines, Banff (Canada), 27-30 Sep 1987; MICROLOG–89-03549). In *Proceedings [of the] seventh NRCC [National Research Council of Canada] symposium on industrial application of gas turbines.* Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

TransCanada PipeLines (TCPL) installed nine Westinghouse W62RM gas turbines in their pumping system in the early 1960s. By 1980, with the price of fuel escalating and the performance of the units deteriorating with age, TCPL was seriously considering replacement with modern higher efficiency units. When a January 1984 performance test on one unit showed power 33% and overall thermal efficiency 24% below rated (well below W62RM fleet average), the unit and data were assessed to determine what, if anything, could be done to restore performance. Over a two-year period, a series of modifications including compressor reblading, turbine blade rejuvenation, and improvements to the sealing and cooling systems were implemented and tested on two units. The latest test in November 1986, with all modifications installed, showed the power to be 4% greater than, and the overall thermal efficiency equal to, the rated value. During the November test, two additional modifications were identified which could, when implemented, give a further 11% increase in power and 5% increase in efficiency. This report describes the analysis, explains the contributions to performance improvement, and summarizes engine test data. 22 figs., 1 tab.

5639 (NRC/ACP–89-03549, pp. 26) **On site heavy maintenance techniques.** Inglis, J.P.; Hobbs, K.C. National Research Council of Canada, Ottawa, ON (Canada). Associate Committee on Propulsion. Sep 1987. (CONF-8709481–: 7. National Research Council of Canada (NRCC) symposium on industrial application of gas turbines, Banff (Canada), 27-30 Sep 1987; MICROLOG–89-03549). In *Proceedings [of the] seventh NRCC [National Research Council of Canada] symposium on industrial application of gas turbines.* Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The Rolls-Royce Avon gas turbine is being used extensively in pipeline compressor stations, many in remote areas. Operational problems with these turbines are outlined and include problems in the front bearing housing, compressor casing and stator, compressor rotor, and rotors in the 00 stage. The biggest single problem was flame tube location wear, particularly in the cold winter months when mass flow increases 30% or more. The measures taken to redesign the various components in order to prevent these problems from recurring are described. A new turbine, the RB211, was designed such that maintenance and inspection in remote field locations are made easier through the use of modular construction. These modules, the air intake casing, intermediate pressure compressor, intermediate casing, high pressure system, and intermediate pressure turbine, are detailed and illustrated. Any one of them can be removed and replaced without disturbing the component parts of the other sections. The ability to change major sections in the field substantially reduces downtime, and module changing can be done by relatively uncomplicated techniques using local labor. The modules are easily transportable by truck or helicopter. 17 figs.

5640 (PB–89-234561/XAB) **Fabrication of S-N-S josephson junctions of Y-Ba-Cu-O/Au/Nb thin film sandwiches.** Akoh, H.; Shinoki, F.; Takahashi, M.; Takada, S. Electrotechnical Lab.,

Tsukuba, Ibaraki (Japan). 1989. 8p. Available from NTIS, PC E10/MF A01.

Text in Japanese; Included in Bulletin of the Electrotechnical Laboratory, Vol. 53, No. 2 79-86(1989).

Researchers have fabricated S-N-S Josephson junctions that consist of Y-Ba-Cu-O/Au/Nb thin-film sandwiches with various thickness of Au barrier. Due to the ac Josephson effect, the Shapiro steps are observed in the S-N-S junctions under microwave radiation. The magnetic field dependence of the critical current shows that the junctions behave as self-field limited Josephson junctions. In addition, from the temperature dependence of the critical current near the transition temperature of the junctions, it is found that the thickness of the Au barrier is shorter than the coherence length of Au.

5641 (PB–89-873988/XAB) **Chemical and biological warfare: Protection, decontamination, and disposal. January 1979-October 1989 (Citations from the NTIS data base). Report for January 1979-October 1989.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 206p. Available from NTISPC N01/MF N01.

Supersedes PB–89-860209.

This bibliography contains citations concerning the means to defend against chemical and biological agents used in military operations, and to eliminate the effects of such agents on personnel, equipment and grounds. Protection is accomplished through protective clothing and masks, and in buildings and shelters through filtration. Elimination of effects includes decontamination and removal of the agents from clothing, equipment, buildings, grounds, and water, using chemical deactivation, incineration, and controlled disposal of material in injection wells and ocean dumping. Other published searches in this series cover chemical warfare detection, defoliants, general studies, biochemistry and therapy, and biology, chemistry and toxicology associated with chemical warfare agents. (This updated bibliography contains 375 citations, 17 of which are new entries to the previous edition.)

5642 (PNL-SA–17355) **Predictive maintenance of rotating equipment.** Berndt, R.H. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 6p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-8910300–1: DOE real property management conference, Las Vegas, NV (USA), 30 Oct - 3 nov 1989). Order Number DE90002730. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper is the summary of a presentation given at the DOE Real Property Management Conference. (JEF)

5643 (SAND–89-0607C) **CTH: A three-dimensional shock wave physics code.** McGlaun, J.M. (Sandia National Labs., Albuquerque, NM (USA)); Thompson, S.L.; Elrick, M.G. Sandia National Labs., Albuquerque, NM (USA). [1989]. 13p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-891214–6: Hypervelocity impact symposium, San Antonio, TX (USA), 12-14 Dec 1989). Order Number DE89016529. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

CTH is a software system under development at Sandia National Laboratories Albuquerque to model multidimensional, multi-material, large deformation, strong shock wave physics. One-dimensional rectilinear, cylindrical, and spherical meshes; two-dimensional rectangular, and cylindrical meshes; and three-dimensional rectangular meshes are currently available. A two-step Eulerian solution scheme is used with these meshes. The first step is a Lagrangian step in which the cells distort to follow the material motion. The second step is a remesh step where the distorted cells are mapped back to the Eulerian mesh. CTH has several models that are useful for simulating strong shock, large deformation events. Both tabular and analytic equations of state are available. CTH can model elastic-plastic behavior, high explosive detonation, fracture, and motion of fragments smaller than a computational cell. The elastic-plastic model is elastic-perfectly plastic with thermal softening. A programmed burn model is available for modelling high explosive detonation. The Jones-Wilkins-Lee equation of state is available for modelling high explosive reaction products. Fracture can be initiated based on pressure or principle stress. A special model is available for moving fragments smaller than a computational cell with statistically the correct velocity. This model is very useful for analyzing fragmentation experiments and experiments with witness plates. This paper describes the models, and novel features of CTH. Special emphasis will be placed on the features that are novel to CTH or are not direct generalizations of two-dimensional models. Another paper by Trucano and McGlaun describes several hypervelocity impact calculations using CTH. (9 refs., 5 figs.)

5644 (UCID–21619) **Design of a custom load cell for a precision assembly application.** Scott, J.J. Lawrence Livermore National Lab., CA (USA). 25 Oct 1989. 26p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90004439. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A custom load cell was designed for a precision assembly application where high sensitivity and minimum deflections were required in two orthogonal directions. The application required that the load cell be integrated into existing micropositioning equipment. The aluminum alloy 2024-T81 was used as the spring material to maximize both strain output and gage heat dissipation. Large area, high resistance gages were selected to minimize heat generation and maximize dissipation. Dual Wheatstone bridge circuits were used to resolve the two orthogonal directions. The spring element was designed for optimal mechanical sensitivity, heat dissipation, and ease of fabrication. The described hardware was fabricated and successfully used to support a major LLNL research program. This paper was written as a case study to benefit future designers of such hardware. 2 refs., 7 figs., 1 tab.

5645 (UCRL–99677) **A simple shell element formulation for large-scale elastoplastic analysis.** Engelmann, B.E.; Whirley, R.G.; Goudreau, G.L. Lawrence Livermore National Lab., CA (USA). Jul 1989. 18p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-891208–9: Winter annual meeting of the American Society of Mechanical Engineers, San Francisco, CA (USA), 10-15 Dec 1989). Order Number DE89015452. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Nonlinear structural mechanics problems arise in a wide variety of disciplines, from automotive crashdynamics to earthquake engineering to nuclear power plant analysis. An important aspect of many of these problems involves the study of shell structures undergoing potentially large displacement but small strains. In addition, material nonlinearity may play a major role. Due to the complexity of solution strategies for nonlinear problems, these analyses can require large amounts of computer time to achieve a solution. Thus, practical developments for nonlinear analysis must balance accuracy and robustness against computational speed. This paper describes a recently developed four-node quadrilateral shell element with good accuracy properties. The element combines many components from other successful mixed formulations in a three-field variational framework, and is formulated in a large-displacement small-strain context. Emphasis has been placed on the development of a simple, low order formulation with good accuracy in a wide range of loading situations. Implementation of complex constitutive models is straightforward in this formulation. In addition, this four-node "flat shell" element is suitable for most widely used contact algorithms. These characteristics make the present formulation amenable to implementation in a general purpose analysis environment. The paper opens with a description of the shell kinematics and governing equations. This is followed by a detailed description of the finite element formulation with particular emphasis on the fields chosen for in-place and transverse variables. Finally, several numerical examples are given to illustrate the performance of the proposed element on both linear and nonlinear problems. 12 refs., 10 figs., 7 tabs.

5646 (UCRL–100652) **Electrical safety in the high voltage laboratory.** Gordon, L.B. (Auburn Univ., AL (USA). Space Power Inst.); Counts, D.L.; Hofer, W.W.; Jordan, C.W.; Kirkewoog, A.E.; Schleicher, B.R. Lawrence Livermore National Lab., CA (USA). Jun 1989. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890665–52: 7. Institute of Electrical and Electronics Engineers pulsed power conference, Monterey, CA (USA), 12-14 Jun 1989). Order Number DE90003026. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In the process of reevaluating the thoroughness and long-term retention of existing electrical safety training programs at Lawrence Livermore National Lab, a new, intensive training program has been

developed. Although it encompasses the electrical safety of utility power it is primarily designed to include the specialized safety issues present in the high energy or pulsed power laboratory. The unique approach is to expose the technical person likely to work in such a hazardous location to a dynamic, thorough, and motivating presentation designed to leave a long lasting appreciation for the issue of laboratory safety. It is believed that this approach is critical to establish and maintain the sense of long-term safety awareness in an individual that is necessary to assure a continually safe work environment. The newly developed electrical safety awareness course uses a variety of multi-media techniques to accomplish the above goals. This paper will present the design and content of the course as well as the results from the initial presentations.

5647 **Vacuum mechatronics first international workshop.** American Vacuum Society Series 7. Belinski, S.E. (California Univ., Santa Barbara, CA (USA)); Shirazi, M.; Hackwood, S.; Beni, G. (eds.). 167p. American Institute of Physics, New York, NY (USA) (1989). Sponsored by American Institute of Physics; American Vacuum Society; California Department of Commerce; National Science Foundation. (CONF-8902123–: 1. international vacuum mechatronics workshop, Santa Barbara, CA (USA), 2-3 Feb 1989).

This report contains papers on the following topics: proposed epitaxial thin film growth in the ultra-vacuum of space; particle monitoring and control in vacuum processing equipment; electrostatic dust collector for use in vacuum systems; materials evaluation of an electrically noisy vacuum slip ring assembly; an overview of lubrication and associated materials for vacuum service; the usage of lubricants in a vacuum environment; guidelines and practical applications for lubrication in vacuum; recent development in leak detector and calibrator designs; the durability of ballscrews for ultrahigh vacuum; vacuum-compatible robot for self-contained manufacturing systems; the design, fabrication, and assembly of an advanced vacuum robotics system for space payload calibration; design criteria for mechanisms used in space; and concepts and requirements for semiconductor multiprocess integration in vacuum. These papers are indexed separately elsewhere.

4204 Heat Transfer and Fluid Flow

Refer also to citation(s) 4980, 4981, 5013, 5172, 5184, 5362, 5374, 5568

5648 (CRIE-T–88038) **Analysis of infrared radiation heating Part 1. One dimensional radiation heat transfer analysis taking account of spectral properties.** Miyanaga, Toshiyuki; Nakano, Yukio. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Mar 1989. 47p. (In Japanese). Order Number DE90725000. Available from NTIS (US Sales Only), PC A03/MF A01.

In order to make more effective use of infrared radiation as thermal source, it is necessary to develop some methods of predicting the heating effect theoretically. In this report, the writers have developed a method of predicting the heating effect quantitatively, taking account of the intensities of radiation of infrared from radiators and the amounts of absorption of infrared by heated materials on each spectral wave length. This method is applicable to one dimensional heating system on a temperature range without transfer of materials such as evaporation. Some experimental tests and calculating studies were carried out on six kinds of heated materials, and the results of calculating studies and experimental tests showed good agreement. The distribution and the temporal variation of temperature inside materials to be heated are estimated by this method, when the radiation intensity of a radiator on each spectral wave length, the amount of absorption of infrared of materials to be heated, thermal conductivity, specific heat, and density are given. It was clarified that this method is effective for the predicting the effect by infrared radiation heating. 7 refs., 38 figs., 3 tabs.

5649 (ENEA-RT-TIB–88-35) **Thermal radiation in a diffuse-gray enclosure.** Cherubini, A. Comitato Nazionale per l'Energia Nucleare, Bologna (Italy). Dipt. Tecnologie Intersettoriali di Base. Mar 1989. 63p. Order Number DE90724616. Available from NTIS (US Sales Only), PC A04/MF A01.

It is known that heat transfer by radiation is quantitatively dominant with respect to transfer by conduction and/or convection, when temperatures involved are high. This report thoroughly deals with heat transfer by thermal radiation in an enclosure partitioned by n components, each one diffuse-gray or black. The subjects developed are: basic concepts and hypothesis on thermal radiation; view factors and absorption factors in an enclosure with algorithmical criteria to determine both of them; radiant thermal fluxes; the 'RAD' program, suitable to calculate accurately and quickly, with the use of two algorithms appropriately developed, the n^2 absorption factors and the n net radiant thermal fluxes.

5650 (ENEA-RT-VEL–89-03) **On the numerical solution of flow transients induced in fluids by moving walls: A one-dimensional treatment.** Barbaro, M. ENEA, Bologna (Italy). Dipt. Reattori Veloci. Jun 1989. 41p. Order Number DE90724610. Available from NTIS (US Sales Only), PC A03/MF A01.

The problem of unsteady flow induced in a compressible fluid by moving walls is of interest in a number of engineering applications. Examples include: the flow in reciprocating-engine cylinders; the flow around centrifugal-pump impellers; the flow induced by the vibration of containment structures. Due to the wall motion, the structure of such flows cannot be efficiently computed by a fixed-grid arrangement. This paper proposes a moving grid solution technique. Two numerical schemes incorporating this technique are presented. A comparative study of these schemes is performed for one-dimensional problem to evaluate relative accuracy, stability and generality.

5651 (ETDE-IT–89-34) **Theoretical/experimental study on vapour velocity effects relative to the condensation of freon 12 on horizontal tube banks.** Boccardi, G.; Fabrizi, F.; Rinaldi, L. ENEA, Casaccia (Italy). Centro Ricerche Energia. Jun 1987. 26p. (In Italian). Order Number DE90724624. Available from NTIS (US Sales Only), PC A03/MF A01.

A theoretical and experimental study on the condensation of a flowing vapour (freon 12) on a horizontal tube bank is presented. A mathematical model was developed, taking into account the flow regimes (laminar, transition and turbulent) of the condensed liquid film and the various types of condensation ('gravity' and 'shear' controlled). Experimental tests were carried out to measure the vapour velocity in various points of the tube bank to verify the mathematical model predictions. These tests were performed in a fully visualized test section, reproducing a typical feedwater heater staggered tube configuration. The measurement of the vapour velocity in some particular geometrical locations was made using hot film anemometer sensors. These were also used for improving performance characteristics in the case of low velocities (0-6 m/s), near the limit of their operating range. Further applications are forecast on large size test sections.

5652 (IEN-DERE-DITRA–01/89) **Turbulent flow in rod bundles.** Moeller, S.V. Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores. 1989. 20p. (In Portuguese). Order Number DE90608606. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Experimental studies have shown that the axial and azimuthal turbulence intensities in the gap regions of rod bundles increase strongly with decreasing rod spacing; the fluctuating velocities in the axial and azimuthal directions have a quasi-periodic behaviour. To determine the origin of this phenomenon, an its characteristics as a function of the geometry and the Reynolds number, an experimental investigation was performed on the turbulent in several rod bundles with different aspect ratios (P/D, W/D). Hot-wires and microsphones were used for the measurements of velocity and wall pressure fluctuations. The data were evaluated to obtain spectra as well as auto and cross correlations. Based on the results, a phenomenological model is presented to explain this phenomenon. By means of the model, the mass exchange between neighbouring subchannels is explained.

5653 (INIS-mf–11564, pp. 203-232) **Distribution factors for one-dimensional equations of two-phase nonequilibrium flows at various phase parameter distributions within channel cross-section.** Wolter, W. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu

Atomnoj Ehnergii v Mirnykh Tselyakh. 1985. (In Russian). (CONF-8410495–: Thermal physics '84: thermal aspects of WWER nuclear reactor safety, Varna (Bulgaria), Oct 1984). In *Thermal physics 84. Thermal aspects of WWER nuclear reactor safety. V. 2. Collection of papers from CMEA seminar, Varna, October 1984.* Order Number DE90705979. Available from NTIS (US Sales Only), PC A14/MF A01; INIS.

A numerical estimate has been carried out for the averaging coefficients (distribution parameters) used in onedimensional equations of continuity, energy and momentum in the drift flow model which provides connection between phase local characteristics and the motion of a volume center in two-phase mixture via the light phase rise velocity (drift velocity). It was shown that the averaging coefficients could differ substantially from unity. The impact of the light phase drift velocity on the coefficient values has been analized. Special attention was paid to the study of two-phase subcooled boiling flows. The obtained results can be used as a data base for correcting the applicability limits for one-dimensional two-phase flow models using the slug approximation of parameter distribution. 15 refs.; 2 tabs.; 7 figs.

5654 (INIS-mf–11564, pp. 295-306) **Temperature distribution near thermocouples within fuel rod imitators with electric heating.** Wolter, W. Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh. 1985. (In Russian). (CONF-8410495–: Thermal physics '84: thermal aspects of WWER nuclear reactor safety, Varna (Bulgaria), Oct 1984). In *Thermal physics 84. Thermal aspects of WWER nuclear reactor safety. V. 2. Collection of papers from CMEA seminar, Varna, October 1984.* Order Number DE90705979. Available from NTIS (US Sales Only), PC A14/MF A01; INIS.

In heat transfer studies surfaces with the direct electrical heating are often employed. In this case using thermocouples for the temperature control results in the electric and temperature field distortions. The error due to thermocouple presense has been measured by means of thermovision. The experiments have shown the value of this error to be comparable with that due to thermal conductivity losses through the electric conductors of the thermocouple. The results of theoretical calculations ogree with the experiment. 1 tab.; 5 figs.

5655 (K/CSD/INF–89/5) **Calculation of surface heat transfer parameters during quenching from surface thermocouple signals.** Park, J.E. (Oak Ridge Gaseous Diffusion Plant, TN (USA)); Ludtka, G.M. Oak Ridge Gaseous Diffusion Plant, TN (USA). [1989]. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC05-84OT21400. (CONF-891208–3: Winter annual meeting of the American Society of Mechanical Engineers, San Francisco, CA (USA), 10-15 Dec 1989). Order Number DE89011620. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

High peak heat flux values (8–9 W/mm^2) of short duration have been measured during cold water quenching of a 152.4-mm (6-in.)-dia nickel tube from an initial temperature of 810°C. Temperatures were measured using thermocouples installed on and beneath the outer surface of the cylinder. The transient boiling surface heat flux has been calculated from these data using an initial least-squares smoothing of the data and an inverse heat transfer technique. The experimental apparatus and technique and the data reduction technique are described. The data are presented, discussed, and compared with previous results from other investigators. The peak heat flux values occurred at a driving temperature difference of about 40–90°C. The peak heat flux moves up the cylinder as the cylinder cools. Cooling is controlled by convection currents generated in the quench bath by the buoyant steam and hot water. 13 refs., 13 figs.

5656 (KFK–4611) **Benard convection in liquid sodium layers.** Kek, V. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter; Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau. Aug 1989. 150p. (In German). Order Number DE90728837. Available from NTIS (US Sales Only), PC A07/MF A01.

In a sodium layer heated from below and cooled from above, the integral Nusselt numbers are determined in a range of Rayleigh numbers $1.5x10^3 < Ra < 2.5x10^5$. The experiments are performed in containers with dimensions of 500 mm in diameter and 15 mm and 45 mm in height. The relevant quantities are evaluated from measured temperature and heating power data. The experiments show that the heat transfer across the layer is determined mainly by heat conduction up to Rayleigh number $Ra \simeq 10^4$. Beyond this value a significant increase of the convective heat transport is observed. At a Rayleigh number of $4x10^4$ the Nusselt number achieves the value Nu = 1.7. This result differs from values given by Nusselt-Rayleigh number correlations reported in the literature for liquids with higher Prandtl number. A regression analysis of the experimental data results empirical correlations for the Nusselt number. A time series analysis of the time dependent temperature signals shows that the measured temperature fluctuations exhibit predominantly stochastic features. However, in the lower range of Rayleigh numbers $1.5x10^3 < Ra < 2x10^4$ certain regular frequencies can be identified from peaks in broadband power density spectra. These frequencies correspond to fluctuations of a period of 80 to 200 seconds. These regular frequencies are explained by instabilities of the cellular pattern in the convection layer reported in the literature. (orig./HP).

5657 (UCRL–21230) **Rayleigh-Taylor instability in compressible fluids: Final report, 1 October 1988–30 September 1989.** Sturtevant, B. (California Inst. of Tech., Pasadena, CA (USA). Graduate Aeronautical Labs.). Lawrence Livermore National Lab., CA (USA); California Inst. of Tech., Pasadena, CA (USA). Graduate Aeronautical Labs. 15 Jun 1989. 180p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90003027. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

The interaction of shock waves with a contact surface between gases of different densities has been studied experimentally and theoretically. The basic mechanism for the instability of perturbations at the interface is baroclinic vorticity generation resulting from the misalignment of the pressure gradient of the shock and the density gradient of the interface. In the present study, the effects of interface density contrast and initial thickness, and incident wave strength on the development of the instability at the interface are investigated. The experiments were performed in a new vertical shock tube facility where the interaction of a shock wave with either a discontinuous interface, formed by a thin (0.5 μm) plastic membrane, or a continuous interface, created by retracting a metal plate initially separating the two gases, was studied. Air was used on one side of the interface and either helium, carbon dioxide, refrigerant-22 or sulphur hexafluoride was used on the other side as the test gas. Experiments to study the time evolution of quasi-sinusoidal perturbations on a continuous interface have shown that the growth rates are reduced as the interface thickness is increased. Experiments were also performed to observe the schlieren visual thickness of plane discontinuous or continuous interfaces with random small-scale perturbations after interaction with the incident shock wave and its reverberations. 84 refs., 70 figs., 14 tabs.

5658 **Theoretical approach to establish deposition mechanism/deposit microstructure relationships.** Tassopoulos, M. (Yale Univ., New Haven, CT (USA). Dept. of Chemical Engineering); O'Brien, J.A.; Rosner, D.E. 21p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-881143–: American Institute of Chemical Engineers annual meeting, Washington, DC (USA), 27 Nov - 2 dec 1988).

Technical Paper 28F.

Despite recent advances in our ability to predict particle deposition rates in convective-diffusion environments, the important connection between resulting deposit properties (effective thermal conductivity, permeability, ...) and deposition mechanism remains poorly understood and only scarcely studied. Accordingly, in this research the authors develop a discrete stochastic model to simulate particulate deposition processes resulting from a combination of deposition mechanisms. They illustrate the model's implications through computer simulations of deposits grown on two- and three-dimensional orthogonal lattices, with every particle following an asymmetric random walk trajectory in the vicinity of the deposit. This comprehensive model generalized two recent stochastic growth models, namely, the Ballistic Aggregation model and the Diffusion

Limited Aggregation model, which now appear as limiting cases. The authors characterize the resulting deposit microstructure via porosity, pore size/area distribution, surface area, transport properties, and examine the evolution of these descriptors with time for different deposition mechanisms. They also examine the effects of particle size polydispersity, spatial orientation, and mean-free path on the resulting deposit structure.

5659 **Theoretical and experimental analysis of the oscillations of a fluid drop immersed in another fluid.** Basaran, O.A. (Oak Ridge National Lab., TN (USA)); Scott, T.C.; Byers, C.H. 1p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-881143–: American Institute of Chemical Engineers annual meeting, Washington, DC (USA), 27 Nov - 2 dec 1988).

Technical Paper 153B.

When the ratio of the drop radius to the distance separating any two drops and the relative importance of gravitational to surface forces are both small, the small amplitude oscillations of a drop of one viscous fluid immersed in another fluid are governed by the nonlinear dispersion relation derived by Miller and Scriven. The dispersion relation has been solved numerically to determine the character of oscillations for arbitrary values of drop size, physical properties of the two fluids, and interfacial tension for two-, three-, and four-lobed motions. The new theoretical results determine the range of validity of the low-viscosity approximations of Miller and Scriven and others and are also shown to be essential for proper interpretation of many previously reported experimental results. New experiments performed with water drops falling in 2-ethyl-1-hexanol, a system of importance in solvent extraction, agree well with the theoretical predictions when drop radius is smaller than a critical size. The frequencies of and decay factors for oscillations of larger drops are better described by the dispersion relation due to Subramanyam, which accounts for the relative motion of the two phases.

5660 **The effect of fluid properties on electric field-enhanced drop formation.** Perona, J.J. (Oak Ridge National Lab., TN (USA)); Basaran, O.A.; Byers, C.H. 1p. American Institute of Chemical Engineers, New York, NY (1988). (CONF-881143–: American Institute of Chemical Engineers annual meeting, Washington, DC (USA), 27 Nov - 2 dec 1988).

Technical Paper 102K.

The hydrodynamics of drop formation from an orifice in an electric field were studied. Experiments with water drops formed in cyclohexane were reported previously, and drop volumes measured were shown to be predicted well by a simple theory. The research has been extended to water drop formation in other organic fluids, including 2-ethyl hexanol, hexanol, and unidecyl alcohol. The results obtained clarify the role of interfacial tension and electrical permittivity in drop formation.

5661 **Annual review of numerical fluid mechanics and heat transfer. Volume 1.** Chawla, T.C. 454p. Hemisphere Publishing, New York, NY (1987).

This book contains papers on fluid mechanics and heat transfer. Topics include: Thermal radiation in particulate media, pressure-velocity coupling in incompressible fluid flow, buckling flows, and complex heat transfer processes in heat-generating horizontal fluid layers.

4205 Materials Testing

Refer also to citation(s) 4559, 5181, 5207, 5412, 5443, 5513, 5708, 5809

5662 (AD-A–211290/2/XAB) **Thermomechanical contact phenomena and wear of sliding components. Final report, 1 January 1987-31 December 1988.** Kennedy, F.E.; Espinoza, B.M.; Pepper, S.M.; Tang, L. Dartmouth Coll., Hanover, NH (USA). Thayer School of Engineering. 31 Jul 1989. 68p. Available from NTIS, PC A04/MF A01.

The objectives of this investigation were to better understand the tribological behavior of ceramic-coated rings sliding against carbon graphite and thermocracking that occurs with some of the ceramic coatings. Sliding wear tests were conducted on Inconel 625 substrates coated with four different materials: chromium oxide, chromium carbide, titanium nitride, and tungsten carbide. Tests were also run to determine the corrosion behavior of the ceramic-coated rings in seawater. Surface profilometry, mass-loss measurements, and microscopy were used to characterize wear, cracking, and corrosion phenomena. Residual stresses and preferred orientations of one of the coatings (TiN) were determined by X-ray diffractometry methods and hardness and modulus of elasticity of the TiN coatings were measured by nanoindentation hardness testing. Coupled with the experimental work was a theoretical analysis of temperatures and stresses in the contact region of the ceramic coating during sliding. The influence of various material and geometric parameters on coating cracking or spalling was studied in the analytical work.

5663 (AERE-R–13082) **Review of non-destructive techniques for the quality checking of encapsulated radioactive waste: 2.** Saunderson, D.H. UKAEA Harwell Lab. (UK). Materials Physics and Metallurgy Div. May 1989. vp Available from H.M. Stationery Office, London, price Pound 14.00.

This report concludes a wide-ranging survey of non-destructive techniques for the Quality Checking of encapsulated radioactive wastes. For completeness of the record, a large number of techniques are listed with an assessment of their relevance. In many cases the properties measured are inappropriate or the physical constraints, particularly those imposed by the encapsulating drum, prevent a technique being used. High-energy X-ray radiography emerges as a likely method. Computer tomography could be added to this with advantage. A few other techniques show possible uses, but none of sufficient promise at present to challenge the choice of X-ray radiography. (author).

5664 (CEGB-TPRD/M–1684/RR88) **Non-contacting thermal wave technique for NDT of coatings and other applications in the CEGB: current status (July 1987).** Corbett, J.; Quigley, M.B.C.; Smith, B.L.; Hart, B. Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs. Oct 1988. 14p. Order Number DE90610102. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This report describes the current status of the photothermal non-destructive testing (NDT) of sprayed coatings on components in conventional and nuclear power plant. Thickness measurements of sprayed coatings have been performed and the thickness resolution capability has been shown to be, in principle, of the order of 1 micrometre. Sub-surface defects down to 0.5mm is size have been detected, using a tightly focused laser beam. The ability to distinguish between penetrated and non-penetrated welds has been illustrated. A portable diode-laser based system is being designed for on-line manufacturing quality assurance and in-situ inspection of coatings. Finally, the potential cost benefit and current research programme are outlined. (author).

5665 (KFK–4595) **Standard and applied material testing methods of austenitic CrNi stainless steels in different nitric acid media - procedures and results.** Leistikow, S.; Kraft, R.; Schanz, G. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung. Jul 1989. 30p. Order Number DE90728841. Available from NTIS (US Sales Only), PC A03/MF A01.

Extended ASTM Standard Huey Testing has been performed in at 120^{0}C boiling 14.4 molar (65%) nitric acid during 15 periods (15x48 = 720 h duration) for quality control of numerous commercial nitric acid resistant austenitic CrNi steels. It was shown how sensitively the chosen testing conditions could differentiate between CrNi steels of the same nominal composition as specified for DIN W.Nr. 1.4306 (AISI Type 304 L), but with varying residual element contents. Within an attempt to differentiate within this group of steels by application of electrochemical methods, potentiostatic tests at 1250 mV in nitric acid of equal concentration and temperature were able to detect remarkable differences in corrosion behaviour already after one hour. Another approach, more typical for the electrochemical potentials during materials application in reprocessing plants of nuclear fuel, gave preference to long-term immersion tests, which were performed in nitric acid of lower concentration and temperature. Reference tests in pure 7 molar, 90^{0}C nitric acid could only reveal by surface attack small differences in steel quality by exposures of 720 h duration. To shorten the test time by an increase of

the redox potential chromium (VI) ions were added to the nitric acid. In a solution of 0,5 g Gr (VI)/l at 90°C remarkable differences in corrosion behavior of the steels - similar to the Huey test results - became measurable by means of gravimetry and metallography already during a short-term exposure of 24-71 h. (orig./MM).

5666 (LA-UR-89-3791) **Effects of parametric variations of complex targets on damage from projectile impact.** Meier, R.W. Los Alamos National Lab., NM (USA). [1989]. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-891214-11: Hypervelocity impact symposium, San Antonio, TX (USA), 12-14 Dec 1989). Order Number DE90003214. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The effects of a hypervelocity projectile striking complex targets have been investigated. The targets consisted of metallic and low-density shock attenuating layers and void regions. The major features of the targets were systematically varied to correlate changes in the targets with the projectile's effectiveness in damaging the targets. Two-dimensional numerical simulations were done with the Eulerian computational fluid dynamics program PINON. Projectile effectiveness against the various targets was measured by determining the maximum pressure, pressure integral, $P^2\tau$ value, and hole size at several locations in the targets. 9 refs., 13 figs., 6 tabs.

5667 (NRC/ACP-89-03549, pp. 19) **Emerging technologies for life cycle management of turbine engine components.** Koul, A.K.; Immarigeon, J.-P.; Wallace, W. National Research Council of Canada, Ottawa, ON (Canada). Associate Committee on Propulsion. Sep 1987. (CONF-8709481-: 7. National Research Council of Canada (NRCC) symposium on industrial application of gas turbines, Banff (Canada), 27-30 Sep 1987; MICROLOG-89-03549). In *Proceedings [of the] seventh NRCC [National Research Council of Canada] symposium on industrial application of gas turbines.* Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This paper reviews recent developments in the technologies used in establishing life limits for gas turbine engine components. Novel nondestructive inspection techniques for microdamage detection in turbine engine components based on small angle neutron scattering, positron annihilation spectroscopy, and neutron diffraction are described. A new procedure for assessing life limits of low cycle fatigue life limited parts, based on defect tolerance and the application of fracture mechanics principles, is also described. The potential impact of these technologies on component life cycle management and the cost of ownership of turbine engines is discussed. 27 refs., 19 figs., 1 tab.

5668 (PNL-SA-16885) **Pulsed EMAT [Electromagnetic Acoustic Transducer] acoustic measurements on a horizontal continuous caster for internal temperature determination.** Boyd, D.M. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 15p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract AC06-76RL01830. (CONF-891024-4: The Metallurgical Society fall meeting: materials week, Indianapolis, IN (USA), 1-5 Oct 1989). Order Number DE90002735. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Development of a Pulsed Electromagnetic Acoustic Transducer (EMAT) through transmission system for acoustic measurements on steel billets up to 1300 degrees C has been completed. Laboratory measurements of acoustic velocity were made, and used to determine the average internal temperature of hot stainless and carbon steel billets. Following the success of the laboratory system development, the laboratory EMAT system was subsequently tested successfully at the Baltimore Specialty Steel Co. on a horizontal continuous caster. Details of the sensor system development and the steel plant demonstration results will be presented. Future directions for the high temperature pulsed EMAT internal temperature concept will be discussed for potential material processing applications. 33 refs., 11 figs.

5669 (SAND-89-0597C) **Fragmentation statistics from Eulerian hydrocode calculations.** Trucano, T.G.; Grady, D.E.; McGlaun, J.M. Sandia National Labs., Albuquerque, NM (USA). 1989. 27p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-891214-10: Hypervelocity impact symposium, San Antonio, TX (USA), 12-14 Dec 1989). Order Number DE90002906. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this paper, we discuss a procedure for computing discrete fragmentation information for terminal ballistics events from the continuum data that emerges from two-dimensional Eulerian hydrocode simulations of these events. The present examples deal with the normal impact of lead cylinders on lead plates at velocities below 1600 m/s. In this regime, the resulting debris is almost exclusively solid lead fragments. We have experimental data of sufficient accuracy to evaluate the extraction of such fragmentation information from code simulations. The problem is interesting because the observed distribution of fragment size would require extreme subgrid resolution in the hydrocode if the statistics were computed directly. Our approach is different. We ask whether or not the general continuum description predicted by the code contains enough information to allow coupling of an analytic fragmentation theory that successfully predicts fragmentation statistics. We believe that this approach is valid, and discuss our current success in matching experimental data. 10 refs., 7 figs., 5 tabs.

5670 (SAND-89-0598C) **Hypervelocity impact calculations using CTH: Case studies.** Trucano, T.G.; McGlaun, J.M. Sandia National Labs., Albuquerque, NM (USA). 1989. 29p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-891214-9: Hypervelocity impact symposium, San Antonio, TX (USA), 12-14 Dec 1989). Order Number DE90002891. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this paper, we discuss the application of CTH, a multi-dimensional Eulerian shock wave physics code, by discussing its application to hypervelocity impact problems. CTH is heavily used for this and other types of applications. We will not attempt to provide a broad discussion of examples and capabilities. Rather, we choose to focus on certain features of CTH that are of interest in gaining understanding of some of the more delicate issues of numerical impact simulations. 14 refs., 15 figs., 1 tab.

5671 (SAND-89-0612C) **High gas pressure acceleration of flier plates: Experimental techniques.** Barker, L.M.; Chhabildas, L.C.; Trucano, T.G.; Asay, J.R. Sandia National Labs., Albuquerque, NM (USA). [1989]. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-891214-8: Hypervelocity impact symposium, San Antonio, TX (USA), 12-14 Dec 1989). Order Number DE90002584. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A facility has been developed for conducting experiments on the launching of flat plates to hypervelocities using driving gas pressures in the range of 40 to 300 GPa. The facility, the instrumentation, and the experimental techniques are described. Launches of flier plates made of W, Ta, Mo, Al, and Lexan have resulted in the disintegration of the flying plate, but a 21-gram Ti-6Al-4V plate has been launched intact to 5.8 km/s. Pressure nonuniformities in the driving gas are a primary cause of the disintegration of most flier plates. Sources of the nonuniformities are discussed, and experiments to decrease them are described. 11 refs., 16 figs.

4210 Combustion Systems

Refer also to citation(s) 4911, 5658

5672 (N-89-26899) **OTVE combustor wall condition monitoring. Final report, November 1986-September 1988.** Szemenyei, B.; Nelson, R.S.; Barkhoudarian, S. Rockwell International Corp., Canoga Park, CA (USA). Aug 1989. 38p. (NASA-CR-182275;NAS-1.26:182275;CONF-880764-: 24. AIAA/ASME/SAE/ASEE joint propulsion conference, Boston, MA (USA), 11-13 Jul 1988). Available from NTIS, PC A03/MF A01.

Conventional ultrasonics, eddy current, and electromagnetic acoustic transduction (EMAT) technologies were evaluated to determine their capability of measuring wall thickness/wear of individual cooling channels in test specimens simulating conditions in the throat region of an OTVE combustion chamber liner. Quantitative

results are presented for the eddy current technology, which was shown to measure up to the optimum 20-mil wall thickness with near single channel resolution. Additional results demonstrate the capability of the conventional ultrasonics and EMAT technologies to detect a thinning or cracked wall. Recommendations for additional eddy current and EMAT development tests are presented.

5673 (N–89-26900) **Investigation of the transient fuel preburner manifold and combustor. Final report.** Wang, Tensee; Chen, Yensen; Farmer, R.C. SECA, Inc., Huntsville, AL (USA); SECA, Inc., Huntsville, AL (USA). Jun 1989. 89p. (NASA-CR–183715;NAS–1.26:183715;SECA–89-10). Available from NTIS, PC A05/MF A01.

A computational fluid dynamics (CFD) model with finite rate reactions, FDNS, was developed to study the start transient of the Space Shuttle Main Engine (SSME) fuel preburner (FPB). FDNS is a time accurate, pressure based CFD code. An upwind scheme was employed for spatial discretization. The upwind scheme was based on second and fourth order central differencing with adaptive artificial dissipation. A state of the art two-equation k-epsilon (T) turbulence model was employed for the turbulence calculation. A Pade' Rational Solution (PARASOL) chemistry algorithm was coupled with the point implicit procedure. FDNS was benchmarked with three well documented experiments: a confined swirling coaxial jet, a non-reactive ramjet dump combustor, and a reactive ramjet dump combustor. Excellent comparisons were obtained for the benchmark cases. The code was then used to study the start transient of an axisymmetric SSME fuel preburner. Predicted transient operation of the preburner agrees well with experiment. Furthermore, it was also found that an appreciable amount of unburned oxygen entered the turbine stages.

5674 (N–89-27980) **Experience with advanced instrumentation in a hot section cascade.** Yeh, F.C.; Gladden, H.J. National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center. 1989. 14p. (NASA-TM–102294;E–4962;NAS–1.15:102294;CONF-891208–: Winter annual meeting of the American Society of Mechanical Engineers, San Francisco, CA (USA), 10-15 Dec 1989). Available from NTIS, PC A03/MF A01.

The Lewis Research Center gas turbine Hot Section Test Facility was developed to provide a real engine environment with known boundary conditions for the aerothermal performance evaluation and verification of computer design codes. This verification process requires experimental measurements in a hostile environment. The research instruments used in this facility are presented, and their characteristics and how they perform in this environment are discussed. The research instrumentation consisted of conventional pressure and temperature sensors, as well as thin-film thermocouples and heat flux gages. The hot gas temperature was measured by an aspirated temperature probe and by a dual-element, fast-response temperature probe. The data acquisition mode was both steady state and time dependent. These experiments were conducted over a wide range of gas Reynolds numbers, exit gas Mach numbers, and heat flux levels. This facility was capable of testing at temperatures up to 1600 K, and at pressures up to 18 atm. These corresponded to an airfoil exit Reynolds number range of 0.5 x 10(6) to 2.5 x 10(6) based on the airfoil chord of 5.55 cm. The results characterize the performance capability and the durability of the instrumentation. The challenge of making measurements in hostile environments is also discussed. The instruments exhibited more than adequate durability to achieve the measurement profile. About 70 percent of the thin-film thermocouples and the dual-element temperature probe survived several hundred thermal cycles and more than 35 hr at gas temperatures up to 1600 K. Within the experimental uncertainty, the steady-state and transient heat flux measurements were comparable and consistent over the range of Reynolds numbers tested.

4220 Mining and Underground Engineering

Refer also to citation(s) 4874, 5676

4230 Marine Engineering

5675 (OTH–88-273) **Sensitivity of shallow water jacket structures to uncertainties in environmental loading.** Department of Energy, London (UK). Offshore Energy Technology Board; Atkins Oil and Gas Engineering Ltd., London (UK). 1988. 74p. Available from Available from H.M. Stationery Office, London, price Pound 27.50.

The Department of Energy (D.En) is concerned to ensure that its support for research and development is directed to those projects which will provide the greatest improvement in the reliability and safety of existing and future offshore facilities. To this end the D.En has commissioned a number of studies to investigate the sensitivity of fixed offshore steel platforms to uncertainties in environmental loading parameters and methodologies. (author).

5676 (OTO–88-010) **Semisubmersible data base. V. 1: Final project report.** Department of Energy, London (UK); University Coll., London (UK). Centre for Marine Technology. 1988. vp. Available from Available from The British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

This document describes the data collected on offshore vessels, and locations for the semisubmersible database commissioned by the Department of Energy. This report presents data on the following topics: (i) vessels and offshore structures; (ii) locations. In the course of this exercise data on other vessels i.e., drillings, floating production systems tensioned buoyant platforms, were also collected but this data have been excluded from this report. The data have been obtained from published literature, in-house information and from the response to two questionnaires issued to industry. These questionnaires were prepared specifically for this activity. However, not all of the questionnaires were returned. (author).

4250 Power Cycles

Refer also to citation(s) 4961, 5305

4260 Components, Electron Devices and Circuits

Refer also to citation(s) 5167, 5182, 5352, 5462, 5524, 5528, 5533, 5644, 5722, 5787, 5807, 6334, 6359, 6360, 6376, 6378, 6387, 6408, 6434

5677 (BNL–43306) **A microwiggler Free-Electron Laser at the Brookhaven Accelerator Test Facility.** Batchelor, K. (Brookhaven National Lab., Upton, NY (USA)); Ben-Zvi, I.; Fernow, R.; Gallardo, J.; Kirk, H.; Pellegrini, C.; van Steenbergen, A.; Bhowmik, A. Brookhaven National Lab., Upton, NY (USA). 26 Sep 1989. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90003643. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We report the design and status of an FEL experiment at the Brookhaven National Laboratory Accelerator Test Facility. A 50 MeV high brightness electron beam will be utilized for an oscillator experiment in the visible wavelength region. The microwiggler to be used is a superferric planar undulator with a 0.88 cm period, 60 cm length and K = 0.35. The optical cavity is a 368 cm long stable resonator with broadband dielectric coated mirrors. 8 refs., 2 figs., 4 tabs.

5678 (CONF-8709110–26) **Using the gain spectrum to determine the beam distribution in the LLNL 5M Paladin experiment.** Prosnitz, D. (Lawrence Livermore National Lab., CA (USA)); Orzechowski, T.J.; Boyd, J.K.; Caporaso, G.J.; Chambers, F.W.; Chong, Y.-P.; Clay, H.W.; Deis, G.A.; Fawley, W.M.; Jong, R.A. Lawrence Livermore National Lab., CA (USA). [1987]. 4p. Sponsored by U.S. Department of Defense; U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. SDIO/SDC-ATC MIPR No.W31RPD-7-D4041. From 9. international free-electron laser conference; Williamsburg, VA (USA); 14-18 Sep 1987. Order Number DE90003049. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

While the LLNL Paladin experiment is in its early stages of development, it has provided a unique opportunity to observe how the free electron laser (FEL) gain spectrum can be determined by the electron beam velocity distribution instead of the natural undulator spectrum. The natural gain, or undulator, spectrum has a width, ≈1/

2N, that is determined only by the number of undulator periods, N = 62, over an interaction length of $L = N\lambda_0 = 5m$. A moderately high-current electron beam of 600A at 42 MeV energy was injected into the undulator with strength $K = eB\lambda_0/2\sqrt{2}\pi mc^2 = 0.9$. The weak-field gain spectrum was measured at 10.6μm optical wavelength by varying the undulator field strength B over a small range to change the resonance condition. The gain spectrum was observed to be roughly antisymmetric in shape with a peak gain (and absorption) of G ≈50%, and a width ≈5 times that of the natural undulator spectrum. The shape, overall width, and peak value of the measured gain spectrum are dramatically altered from the idealized gain spectrum, and in this case, are determined primarily by the distribution of electron velocities along the undulator axis. The gain spectrum from an idealized electron beam would be approximately symmetric with a width only slightly larger than the natural undulator spectrum, and a peak value G ≈20.

5679 (CONF-8910120–4) **Fabrication of superconductor coils.** Dorris, S.E.; Dusek, J.T.; Picciolo, J.J.; Leu, H.J.; Singh, J.P.; Cazzato, A.; Poeppel, R.B. Argonne National Lab., IL (USA). Oct 1989. 11p. Sponsored by U.S. DOE Conservation & Renewable Energy. DOE Contract W-31109-ENG-38. From 1. international ceramic science and technology congress; Anaheim, CA (USA); 31 Oct - 3 nov 1989. Order Number DE90003571. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Small coils of superconducting $YBa_2Cu_3O_{7-x}$(123) can be formed in the green state using a layered superconductor/insulator tape. In this approach, the insulator prevents contact between the turns of the coil during firing. The insulator must be chemically compatible with 123 during firing, and ideally should match 123 with respect to firing shrinkage and thermal expansion. Fabrication of small coils from the layered superconductor/insulator composites 123/Y_2BaCuO_5 and 123/$BaCuO_2$ will be discussed. The issue of chemical compatibility will be addressed, and measurements of the firing shrinkage and thermal expansion will be presented for 123 and the two insulators Y_2BaCuO_5 and $BaCuO_2$. In addition, the superconducting properties of 123 in the composites will be presented. 8 refs., 3 figs.

5680 (DOE/ER/13191–10) **Kinetic studies following state-selective laser excitation: Progress report, March 15, 1987–March 14, 1990.** Keto, J.W. Texas Univ., Austin, TX (USA). Dept. of Physics. Oct 1989. 30p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-84ER13191. Order Number DE90003232. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The objective of this contract is the study of state-to-state, electronic energy transfer reactions following two-photon laser excitation. We have chosen to study reactions of Xe $5p^5np$ because of their relevance to the XeCl excimer laser. We are studying deactivation reactions in collisions with heavy atoms such as Ar, Kr, and Xe and reactive collisions with chlorides. The reactants are excited by multiphoton laser absorption. Product channels are observed by their fluorescence, or by laser induced fluorescence using a second color laser. 36 refs., 16 figs., 5 tabs.

5681 (ENEA-RT-TIB–88-29, pp. 43-49) **Interferometrical diagnostics of an XeCl discharge.** De Angelis, A. (ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base); Di Lazzaro, P.; Garosi, F.; Giordano, G.; Letardi, T. ENEA, Frascati (Italy). Centro Ricerche Energia. Dec 1988. (CONF-8806443–: 1. international conference on new laser technologies and applications, Olympia (Greece), 19 Jun 1988). In *Contributions to the 1st international conference on new laser technologies and applications (Olympia, 19-23 Jun 1988).* Order Number DE89609812. Available from NTIS (US Sales Only), PC A06/MF A01.

The recently improved understanding of the factors governing the stability of excimer laser discharge has stimulated the effort to extend the output duration of the self-sustained, discharge-pumped XeCl laser up to the microsecond region. With the aim of increasing knowledge about the mechanisms which determine the premature termination of the excimer laser pulses, this paper summarizes some of the holographic interferometric measurement results of an X-ray preionized, self-sustained discharge XeCl laser. The time and space resolved behaviour of the electron density generated in the active medium was measured by means of a Mach-Zehnder holographic interferometry set-up. The experimental results led to some speculations that can be summarized as follows: - hot spots develop in the cathode sheat at the beginning of the discharge; - the growth of a well defined filament from each hot spot is promoted by halogen and possibly by the excited neutral gas; - filament growth leads to glow discharge collapse, and strong induced inhomogeneities allow the premature lasing disruption well before the occurrence of peak pumping current and electron density.

5682 (ENEA-RT-TIB–88-29, pp. 51-59) **SFUR laser field expansion in Gaussian beams.** Barbini, R. (ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base); Colao, F.; Petri, A. ENEA, Frascati (Italy). Centro Ricerche Energia. Dec 1988. (CONF-8806443–: 1. international conference on new laser technologies and applications, Olympia (Greece), 19 Jun 1988). In *Contributions to the 1st international conference on new laser technologies and applications (Olympia, 19-23 Jun 1988).* Order Number DE89609812. Available from NTIS (US Sales Only), PC A06/MF A01.

The output laser field of a self filtering unstable resonator (SFUR) is expanded in Laguerre-Gaussian solutions of the Helmoltz ware equation paraxial approximation. The relative contributions of different modes are evaluated and main parameters of the laser beam, such as waist are computed. A way is proposed topropagete the output laser beam in free space by means of LG solutions.

5683 (ENEA-RT-TIB–88-41) **Free electron laser operation in the intermediate gain region.** Dattoli, G.; Torre, A.; Centioli, C.; Richetta, M. ENEA, Frascati (Italy). Centro Ricerche Energia. Apr 1989. 16p. Order Number DE90724614. Available from NTIS (US Sales Only), PC A03/MF A01.

Submitted to IEEE Journal of Quantum Electronics.

This paper explores the modification induced on the well known antisymmetric gain function of free electron lasers when the gain coefficient ranges up to 10. It is pointed out that deviations from the linear regime are present for gain coefficients greater than or equal to 0.5. A simple perturbative analysis, which accounts remarkably well for the corrections to the linear gain formula gain coefficients equal to 10 and the effect of the in-homogeneous broadening are also discussed. This analysis is limited to the case of a continuous e-beam. Therefore slippage and lethargy mechanisms, which also play a significant role and should be carefully analyzed, are not included.

5684 (ENEA-RT-TIB–88-45) **Analytical treatment of the SFUR cavity integral equation.** Barbini, R.; Colao, F.; Orsitto, F.; Petri, A. ENEA, Frascati (Italy). Centro Ricerche Energia. May 1989. 12p. Order Number DE90724609. Available from NTIS (US Sales Only), PC A03/MF A01.

Submitted to Nuovo Cimento.

Soon after the first proposal for the new laser Self Filtering Unstable Resonator (SFUR), efforts began to build up a mathematical framework for a general understanding of the physical behaviour of the cavity, and several particular cases were dealt with in literature, both numerically and analytically. This paper presents an approximate, but quite general method for solving analytically the integral equation related to a SFUR laser resonator. It allows for the writing of approximate modes and losses of the cavity in a closed form. The treatment of the SFUR problem is based upon the paraxial appproximation of the scalar field wave equation and on its propagation Green function, i.e. the Fresnel integral.

5685 (ENEA-RT-TIB–88-46) **Contributions to the one-day informal workshop on FEL (Frascati, 26 Sep 1988).** ENEA, Frascati (Italy). Centro Ricerche Energia. May 1989. 19p. (CONF-8809421–Exc.: Workshop on FEL, Frascati (Italy), 26 Sep 1988). Order Number DE90705980. Available from NTIS (US Sales Only), PC A03/MF A01.

Paper presented at one-day informal workshop on FEL (Frascati, 26 Sep 1988).

Individual contributions in this workshop are separately indexed.

5686 (EPRI-CU–6498) **Status of static UPS [uninterruptible power supplies] applications in the United States: Final report.** Chester, T.L. (Chester and Schmidt Consultants, Oakland, CA

(USA)); Schmidt, R.V. Electric Power Research Inst., Palo Alto, CA (USA); Chester and Schmidt Consultants, Oakland, CA (USA). c Nov 1989. 92p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The advent of microelectronic circuits and components, which are found in most electrical equipment, has resulted in the need to protect this equipment from loss of electric power or deviations in its frequency, voltage and sinusoidal wave shape. The uninterruptible power supply (UPS) generally offers this type of protection. This report summarizes the findings and conclusions of an assessment of applications for static UPS systems in the US. The study is primarily based on a survey of three groups: (1) users of UPS equipment, (2) manufacturers and suppliers of UPS equipment, and (3) electric utilities. The study found that UPS systems are perceived to be comprehensive in their protection against power losses or deviations. Static UPS dominates the UPS market, almost a 90% market share, and this dominance should continue in the future. The most common application of static UPS today relates to computers and is expected to remain so in the future. Two-thirds of the surveyed electric utilities anticipate the doubling of the UPS market in next decade. This growth in UPS sales will primarily result from purchases by new users. The assessment concludes that power interruptions and fluctuations are of increasing concern to both electric utilities and their customers. Electric customers want more information on how to solve these power problems and on how to specify and select UPS equipment. Electric utilities can expect to continue providing to their customers (1) information on power problems and possible solutions and (2) limited assistance and advice in diagnosing and correcting power problems. However, in the future, electric utilities may play a greater role, for example, selling UPS or similar equipment. 23 refs., 19 figs., 32 tabs.

5687 (LA-UR–89-3763) **Initial optical transition radiation measurements of the electron beam for the Boeing Free-Electron Laser experiment.** Lumpkin, A.H. (Los Alamos National Lab., NM (USA)); Fiorito, R.B.; Rule, D.W.; Dowell, D.H.; Sellyey, W.; Lowrey, A.R. Los Alamos National Lab., NM (USA). [1989]. 25p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-36. (CONF-8908134–18: 11. international free electron laser conference, Naples, FL (USA), 28 Aug - 1 sep 1989). Order Number DE90003396. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The potential for characterization of electron beams at ~100 MeV at the Boeing Free-Electron Laser (FEL) facility by optical transition radiation (OTR) techniques has been demonstrated as an important complement to other diagnostic means. Electron beam properties such as spatial profile and position, current intensity, emittance, and energy were made accessible in an on-line manner. Initial examples including transport through the 5-m wiggler and the resolution of Cerenkov radiation and spontaneous emission radiation competitive sources are discussed. 11 refs., 13 figs.

5688 (LA-UR–89-3786) **Comprehensive, nonintercepting electron-beam diagnostics using spontaneous emission.** Lumpkin, A.H. Los Alamos National Lab., NM (USA). [1989]. 25p. Sponsored by U.S. Department of Defense; U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-8908134–17: 11. international free electron laser conference, Naples, FL (USA), 28 Aug - 1 sep 1989). Order Number DE90003211. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Characterization and optimization of electron-beam parameters are important aspects of optimizing free-electron laser (FEL) performance. The visible spontaneous emission (λ~650 nm) from the 5-meter long undulator of the Boeing FEL experiment can be characterized in sufficient detail with a streak/spectrometer to deduce time-resolved electron-beam spatial position and profile, micropulse duration, and energy. 7 refs., 13 figs., 2 tabs.

5689 (LBL–27745) **Superconducting magnets in space.** Green, M.A. Lawrence Berkeley Lab., CA (USA). Aug 1989. 8p. Sponsored by U.S. DOE Energy Research; National Aeronautics and Space Administration. DOE Contract AC03-76SF00098. (CONF-891208–23: Winter annual meeting of the American Society of Mechanical Engineers, San Francisco, CA (USA), 10-15 Dec 1989). Order Number DE90002671. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Applications for superconducting magnets in space include particle astrophysics detectors, semiconductor crystal growth, magnetic refrigerators to reach temperatures of a few millikelvin and magnetic energy storage. Superconducting magnets are well suited for use in space because they consume very little power, and superconductors can operate at current densities which are much higher than conventional conductors. This paper presents the general requirements for superconducting magnets in space. The paper discusses the selection of a cryogenic working fluid and the selection of superconductor for space magnets. A 260 mm warm bore 3 T solenoid and the ASTROMAG particle astrophysics experiment solenoid for the space station are presented as examples of superconducting magnetic technology for use in space. 15 refs., 5 figs., 2 tabs.

5690 (N–89-17214) **Theoretical studies of solar lasers and converters. Progress report 15 May-31 December 1988.** Heinbockel, J.H. Old Dominion Univ., Norfolk, VA (USA). Dec 1988. 42p. (NASA-CR–184589;NAS–1.26:184589). Available from NTIS, PC A03/MF A01.

A second computer program was developed for the simulation of an n - C3F7I iodine laser. The computer program is given in Appendix A and a typical output from the computer program is illustrated in Appendix B.

5691 (NRC/ACP–89-03549, pp. 10) **Precise gas turbine fuel control.** Smith, G.E. (En-tronics Controls, Mount Vernon, OH (USA)). National Research Council of Canada, Ottawa, ON (Canada). Associate Committee on Propulsion. Sep 1987. (CONF-8709481–: 7. National Research Council of Canada (NRCC) symposium on industrial application of gas turbines, Banff (Canada), 27-30 Sep 1987; MICROLOG–89-03549). In *Proceedings [of the] seventh NRCC [National Research Council of Canada] symposium on industrial application of gas turbines.* Available from PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A microprocessor-based fuel control system for gas turbines called Flexitrend is described. The system is modular, with plug-in printed circuit cards, and each system accepts three parallel processors. Communications interfacing and diagnostics are incorporated into the system. The system has been tested and applied in a Canadian gas transmission station with satisfactory results. Advantages of the digital fuel control over analog controls include programmability to suit specific user needs, ease of calibration, and a wide range of functions including fuel control, sequencing, surge control, temperature monitoring, and vibration monitoring. 3 figs.

5692 (SAND–89-2109C) **The interface of a finite-difference time-domain electromagnetics code with a linear transmission-line/circuit code.** Turner, C.D.; Riley, D.J.; Bacon, L.D. Sandia National Labs., Albuquerque, NM (USA). [1989]. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-891097–2: High powered microwave and broadband radio frequency propagation/phenomenology/methodology workshop, Livermore, CA (USA), 23-26 Oct 1989). Order Number DE90002905. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Finite-Difference Time-Domain (FDTD) electromagnetics codes have been used for many years to predict the electromagnetic pulse (EMP) and electromagnetic radiation (EMR) response of systems of low to moderate complexity. Rarely, or perhaps never, have these predictions included the calculation of the response of internal circuitry "In-Line" with the calculation of the external response of the system. This paper describes a technique to combine an FDTD code with a transient circuit analysis code so that coupling to circuit elements and/or IC pins can be computed directly. This allows the response of internal circuitry to be computed without resorting to a solution involving several steps utilizing different analysis methods. 3 refs., 7 figs.

5693 (SAND–89-2259) **Very low energy ignition of pyrotechnics using a semiconductor bridge (SCB).** McCampbell, C.B. (SCB Technologies, Inc., Albuquerque, NM (USA)); Bickes,

R.W. Jr.; Schlobohm, S.L. Sandia National Labs., Albuquerque, NM (USA); SCB Technologies, Inc., Albuquerque, NM (USA). Nov 1989. 17p. Sponsored by U.S. DOE Management & Administration. DOE Contract AC04-76DP00789. (CONF-8910224–1: American Defense Preparedness Association annual meeting, New Orleans, LA (USA), 3-4 Oct 1989). Order Number DE90002645. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Electroexplosive devices conventionally use small metal bridgewires (hot wires) to ignite pyrotechnic and other energetic powders. Typically, hot-wire pyrotechnic ignition takes place a few milliseconds after a current pulse of at least 20 mJ is applied to the bridgewire. In contrast, we report here a new means for ignition that produces a usable explosive output in less than 125 μs after application of a current pulse of less than 2 mJ energy to the device. Our igniter is a semiconductor bridge (SCB) which is a heavily doped polysilicon region defined on a silicon substrate. Despite the low energies needed for powder ignition, SCBs have excellent no-fire characteristics, better than the hot wires, because of the intimate contact of the SCB bridge with the underlying substrate. In addition, experiments show very good electrostatic discharge characteristics; application of the current pulse obtained from a 500-pF capacitor charged to 25 kV to our SCB test devices in series with a 5000-Ω resistor produced no bridge damage. In this paper we will discuss the energy required for explosive ignition with SCBs as a function of bridge size and ESD tests. We will also briefly discuss SCB processing and die mounting procedures that lend themselves to automated component assembly. 2 refs., 5 figs., 1 tab.

5694 (UCID–21543) **NOISE: A nonlinear optimization induction free-electron laser systems engineering code.** Blackfield, D.T. (TRW, Inc., Redondo Beach, CA (USA)). Lawrence Livermore National Lab., CA (USA). Aug 1989. 36p. Sponsored by U.S. Department of Defense. DOE Contract W-7405-ENG-48. Order Number DE90004438. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

We have developed a computer code to assist in the design of a ground-based induction free-electron laser (FEL) proposed for construction at the White Sands Missile Range. Called NOISE (for Nonlinear Optimization Induction Free-Electron Laser Systems Engineering), the code contains algorithms for modeling and costing the eight basic IFEL assemblies (accelerator, amplifier, master oscillator, optical conditioning, controls and data acquisition, ancillary and alignment systems, prime power, and technical facilities). A set of nonlinear equations is used to optimize a figure of merit (FOM) subject to various engineering constraints. The FOM is typically total cost (less facilities costs) but may be any combination of variables used by NOISE. The NOISE architecture is highly modular so that assembly routines can be easily modified. Trade studies can be quickly performed over a wide range of dimensions (up to 34 variables with up to 12 constraints). In addition, NOISE contains a "spreadhseet" or benchmark mode that calculates feasible, but not necessarily optimized, design points. We review various nonlinear optimization techniques, show how the techniques influenced NOISE development, and describe in detail the code's subroutines and capabilities. 14 refs., 17 figs., 6 tabs.

5695 (UCRL–100354) **Avalanche photoconductive switching.** Pocha, M.D.; Druce, R.L.; Wilson, M.J.; Hofer, W.W. Lawrence Livermore National Lab., CA (USA). [1989]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8907168–1: 7. IEEE pulsed power conference, Monterey, CA (USA), 11-14 Jul 1989). Order Number DE90002980. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper describes work being done at Lawrence Livermore National Laboratory on the avalanche mode of operation of laser triggered photoconductive switches. We have been able to generate pulses with amplitudes of 2 kV–35 kV and rise times of 300–500 ps, and with a switching gain (energy of output electrical pulse vs energy of trigger optical pulse) of 10^3 to over 10^5. Switches with two very different physical configurations and with two different illumination wavelengths (1.06 μm, 890 nm) exhibit very similar behavior. The avalanche switching behavior, therefore, appears to be related to the material parameters rather than the optical wavelength or switch geometry. Considerable further work needs to be done to fully characterize and understand this mode of operation. 3 refs., 6 figs.

5696 (UCRL–101071) **Waveguide effects in superradiant free-electron lasers.** Sharp, W.M. (Lawrence Livermore National Lab., CA (USA)); Yu, S.S.; Pierini, P.; Cerchioni, G. Lawrence Livermore National Lab., CA (USA). [1989]. 24p. Sponsored by U.S. Department of Defense; U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8908134–19: 11. international free electron laser conference, Naples, FL (USA), 28 Aug - 1 sep 1989). Order Number DE90003605. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A quasi three-dimensional time-dependent particle simulation has been developed to model slippage effects in a single-pass microwave free-electron laser. The code is used here to model the large-amplitude "superradiant" signal that can develop in the slippage region of constant-current beams. Results are presented for single-mode and multiple-code cases, and the effects of the waveguide dimensions, detuning, energy spread, and the initial power in the modes are discussed. 14 refs., 7 figs., 2 tabs.

5697 (UCRL–101633) **Fabrication of an explosive driven linear magnetic flux generator.** Steffani, C.P. Lawrence Livermore National Lab., CA (USA). Jul 1989. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8910296–2: American Electroplaters and Surface Finishers symposium, Las Vegas, NV (USA), Oct 1989). Order Number DE90002994. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Lightweight, high power electrical generators are required for aerospace and defense applications. Single use, linear designs offer high current output from a small package. Electrical current magnifications of the order of 100 to 200 times are expected to be achieved, with higher efficiencies on the horizon. A method of fabricating one of these units, which includes electroforming copper on a precision machined, composite aluminum/epoxy mandrel is described. 4 refs., 5 figs., 2 tabs.

5698 Calculated performance of the lasertron versus a two-cavity klystron. Tallerico, P.J. (Los Alamos National Lab., MS H827, Los Alamos, NM (US)). pp. 160 of Conference record of the 1988 IEEE international conference on plasma science (abstracts). IEEE Service Center, Piscataway, NJ (1988). (CONF-880651–: IEEE international conference on plasma science, Seattle, WA (USA), 6-8 Jun 1988).

Technical Paper 2C4.

Several authors have calculated the dc to rf conversion efficiency of the lasertron, and there are many calculations of klystron efficiency. Because the lasertron is a new device, there is only the Japanese experiment at KEK to compare with the calculations. The KEK experiment, while it is encouraging, has not yet come close to either the present state of the klystron art or to the optimistic predictions of the computer. The author has prepared a 2 1/2 dimensional computer code to analyze both the lasertron and the klystron with the same model and assumptions. The purpose of this code is to compare the calculated performances for both devices while making the same assumptions. The application is for light-weight, high-power rf systems. Preliminary results have been calculated for UHF and L-band cases, and the electrical efficiency is higher for the lasertron than for the two-cavity klystron. A small experimental program to build a working output section of a lasertron at L-band at Los Alamos is described.

5699 Measurement of stimulated thermal Rayleigh scattering instability. Karr, T.J. (Lawrence Livermore National Lab., CA (USA)); Rushford, M.C.; Murray, J.R. pp. 443 of OSA conference on lasers and electro-optics (1989 Technical Digest series). Optical Society of America, Washington, DC (1989). (CONF-890423–: CLEO '89: conference on lasers and electro optics, Baltimore, MD (USA), 24-28 Apr 1989).

Technical Paper WJ3.

Spatial variations of a laser beam propagating in an absorbing medium are amplified by stimulated thermal Rayleigh scattering. Small perturbations of wavelength Λ on a beam of optical wavelength λ and path length z are predicted to grow asymptotically. The principal damping mechanisms are thermal diffusion, inhomogeneous convection, and turbulent mixing of the medium. When growth exceeds damping, small perturbations, either seeded or from

noise, grow in time and space until they are comparable to the unperturbed beam. An experiment was performed to observe the growth of perturbations in a homogeneous path and measure the asymptotic growth rate. The data were analyzed by Fourier transforming each OCD line and integrating the power near the spatial carrier frequency generated by the shearing interferometer to get the time-dependent power p(f) in the perturbation. The asymptotic growth rate was estimated by the least-squares fit to p(f) with a diffusion correction. The measured growth rate vs Λ is in good agreement with analytic predictions from Rytov perturbation theory.

5700 All-implanted planar buried heterostructure, graded index, separate confinement heterostructure laser in GaAs/AlGaAs. Vawter, G.A. (Sandia National Labs., Albuquerque, NM (USA)); Myers, D.R.; Brennan, T.M.; Hammons, B.E. pp. 443 of OSA conference on lasers and electro-optics (1989 Technical Digest series). Optical Society of America, Washington, DC (1989). (CONF-890423–: CLEO '89: conference on lasers and electro optics, Baltimore, MD (USA), 24-28 Apr 1989).

Technical Paper THK16.

The authors report operation of an all-implanted buried heterostructure, graded index, separate confinement heterostructure (PBH GRINSCH) laser in GaAs/AlGaAs. In this structure, ion implantation is used as an alternative to complicated regrowth technologies to form p-n-p-n current blocking layers and to create a buried heterostructure waveguide. This structure represents a significant reduction in the fabrication complexity of high quality, index guided laser diodes. They show a schematic cross section of the PBH GRINSCH laser. High efficiency of 0.80 W/A and reasonable threshold currents were obtained. It is expected that threshold currents will decrease and efficiency increase as the device design and processing are improved.

5701 Two-photon-excited stimulated emission from atomic oxygen in flames and cold gases. Goldsmith, J.E.M. (Sandia National Labs., Albuquerque, NM (USA)); Alden, M.; Westblom, U. pp. 443 of OSA conference on lasers and electro-optics (1989 Technical Digest series). Optical Society of America, Washington, DC (1989). (CONF-890423–: CLEO '89: conference on lasers and electro optics, Baltimore, MD (USA), 24-28 Apr 1989).

Technical Paper THE3.

The authors describe their observation of stimulated emission (SE) from the atomic oxygen $3^3P - 3^3$ transition at 845 nm following two-photon excitation of the $2^3P - 3^3$ transition using 226-nm laser radiation. They studied this SE process in flames and room temperature flows of O_2 and N_2O, comparing its behavior to fluorescence (FL) signals acquired simultaneously. Rapid depletion of the laser-excited state by the SE process may impact the use of diagnostic techniques based on multiphoton excitation in oxygen and other species. The strength of the SE signal suggests that it may have applications as a diagnostic technique. To prove that the signal observed in the direction of the laser beam as in fact SE, they measured the relative strengths of the forward direction signal and the FL collected at right angles. Because FL and SE have distinctly different dependences on the density of excited atoms or molecules responsible for their emission, their signals should behave differently as the excited state density is varied through changes is excitation conditions. The difference in the behavior of the signals, especially evident at the lower intensities is shown.

5702 Spectroscopic, thermal, and lasing features of chromium- and neodymium-doped gadolinium scandium aluminum garnet. Sumida, D.S. (Hughes Research Labs., Malibu, CA (USA)); Rockwell, D.A.; Mangir, M.S.; Shinn, M.D. pp. 443 of OSA conference on lasers and electro-optics (1989 Technical Digest series). Optical Society of America, Washington, DC (1989). (CONF-890423–: CLEO '89: conference on lasers and electro optics, Baltimore, MD (USA), 24-28 Apr 1989).

Technical Paper WM6.

Over the past few years, significant enhancements in lasing efficiency have been well established using chromium sensitizers in neodumium-doped garnets. In particular, Cr:Nd:GSGG has drawn much attention. One characteristic aspect of these gallium garnets is their reduced thermal conductivity. This results in increased effects of heat loading and requires special attention in high average power laser designs. By contrast, Cr:Nd:GSAG, a chromium sensitized neodymium-doped aluminum garnet, possesses an increased thermal conductivity value relative to Cr:Nd:GSGG while yet maintaining an improved pumping efficiency. The authors discuss the thermal handling capability of this material relative to Cr:Nd:GSGG and Nd:YAG and the benefits of its chromium sensitized pumping efficiency based on the presented data. Cr:Nd:GSAG appears to be a promising candidate for many high average power solid state laser applications. Their characterization study of this aluminum garnet in terms of its spectroscopic, thermal, and lasing properties is outlined.

5703 Cloud hole boring with infrared chemical lasers. Quigley, G.P. (Los Alamos National Lab., NM (USA)); York, G.W.; Waggoner, A.P.; Radke, L.F.; Townsend, S.W. pp. 443 of OSA conference on lasers and electro-optics (1989 Technical Digest series). Optical Society of America, Washington, DC (1989). (CONF-890423–: CLEO '89: conference on lasers and electro optics, Baltimore, MD (USA), 24-28 Apr 1989).

Technical Paper THK39.

The authors have developed long pulse (>50μs), high energy (as much as 2.5-kJ) chemical lasers (DF-CO_2 transfer), which are used to clear a 6-cm hole in the simulated clouds. They show initial attempts at clearing using a 120-J 50μs long CO_2 laser pulse at 10.6 μm. In this case, the probe laser wavelength was 6328 A, and the initial cloud conditions attenuated this beam by 30%. The CO_2 laser pulse improved the transmission to 90%, but recondensation and other processes have closed the partially cleared path with a time constant of 300 ms. They cover a full range of clearing conditions including higher pulse energies and different pulse lengths. The major focus is the phenomena effecting hole closure and the optical quality of the cleared channel.

5704 High average power 2-D laser diode arrays on silicon microchannel coolers. Mundinger, D. (Lawrence Livermore National Lab., CA (USA)); Beach, R.; Benett, W.; Solarz, R.; Sperry, V.; Ciarlo, D. pp. 443 of OSA conference on lasers and electro-optics (1989 Technical Digest series). Optical Society of America, Washington, DC (1989). (CONF-890423–: CLEO '89: conference on lasers and electro optics, Baltimore, MD (USA), 24-28 Apr 1989).

Technical Paper FH5.

Due to significant improvements in efficiency and reliability, diode laser arrays are becoming very attractive both as pump sources for practical solid state lasers and direct sources of coherent radiation. These uses, however, are frequently limited by current packaging technologies which are adequate only for low power or low duty factor applications. The authors have developed compact 2-D arrays that are capable of supplying high average power density in an architecture that can be scaled to large areas. They show a schematic view of a basic rack and stack design. The assembled device is shown. They demonstrated multiwatt cw operation per 3-mm bar in several packages using this design. Additional implementations are discussed which allow direct bonding of the diode to the silicon structure. Fabrication techniques and issues, performance characteristics, design considerations, and reliability of these packages are also discussed.

43 PARTICLE ACCELERATORS

4301 Design, Development, and Operation

Refer also to citation(s) 5257, 5677, 5694, 5696, 5737, 5778

5705 (BNL–43465) **Proposal for a study of laser acceleration of electrons using micrograting structures at ATF (Phase 1).** Chen, W. (Brookhaven National Lab., Upton, NY (USA)); Claus, J.; Fernow, R.C.; Fischer, J.; Gallardo, J.C.; Kirk, H.G.; Kramer, H.; Li, Z.; Palmer, R.B.; Rogers, J.; Shrinvasan-Rao, T.; Tsang, T.; Ulc, S.; Veligdan, J.; Warren, J.; Bigio, I.; Kurnit, N.; Brookhaven National Lab., Upton, NY (USA). 29 Oct 1989. 24p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90003699. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We propose to investigate new methods of particle acceleration using a short-pulse CO_2 laser as the power source and grating-like

structures as accelerator "cavities". Phase I of this program is intended to demonstrate the principle of the method. We will focus the laser light to a 3 mm line on the surface of the microstructure. The structure is used to transform the electric field pattern of the incoming transversely polarized laser beam to a mode which has a component along the electron beam direction in the vicinity of the surface. With 6 mJ of laser energy and a 6 ps pulse length, the electric field in the spot will be around 1 GV/m. The electron beam from the Brookhaven Accelerator Test Facility (ATF) will be focused transversely within the few micron transverse dimension of the microstructure. The maximum expected acceleration for a 1 GV/m field and a 3 mm acceleration length is 3 MeV. 17 refs., 11 figs., 2 tabs.

5706 (DOE/FTR–90002952) **[Accelerators of heavy ions]: Foreign trip report, September 29–October 18, 1989.** Ruggiero, A.G. Brookhaven National Lab., Upton, NY (USA). 6 Nov 1989. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90002952. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The purpose of this trip to Italy was twofold: the review projects of LASA, a northern Italian laboratory, under request of INFN, and to attend the XV Workshop on the European Hadron Facility (EHF) in Lecce, south Italy.

5707 (INIS-mf–11562, pp. 26) **Radiation protection problems in building medical accelerators.** Hrabovcova, A. (Vyskumny Ustav Preventivneho Lekarstva, Bratislava (Czechoslovakia)); Nikodemova, D.; Kubu, M. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. CYCLOTRONS/shielding; LINEAR ACCELERATORS/shielding; CYCLOTRONS; SHIELDING; NUCLEAR MEDICINE; RADIATION PROTECTION

5708 (IPJ–2018/ZDAJ/PL/B) **Electron linear accelerator for industrial radiography.** Bigolas, J.; Izewska, J.; Kulinski, St.; Ludkiewicz, B.; Pachan, M. Institute for Nuclear Studies, Otwock-Swierk (Poland). 1985. 47p. (In Polish). Order Number DE90610934. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Received in 1988.

The report presents full description of the design, construction and running up of prototype of 4 MeV electron linear accelerator. The principles of operation and the construction of various parts of the accelerator together with their functional links are also given. The accelerator is destined for radiographic control of materials and industrial goods. 21 refs., 23 figs. (author).

5709 (LA-UR–89-3713) **New results on (LAMPF II) superconducting linac cost.** Schaffer, G. Los Alamos National Lab., NM (USA). [1989]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8910306–1: 15. European Hadron Facility workshop, Lecce (Italy), 9-14 Oct 1989). Order Number DE90003167. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A consolidated cost estimate for a superconducting 800 MeV extension of the LAMPF I linac is presented in this note. Based on recent CERN-LEP tender results for 20 superconducting cavities, the cost of a superconducting linac structure (402.5 MHz) can be projected with much better accuracy than so far. The total construction cost for an 800 MeV extension amounts to 99.5 M$, buildings, cryoplant etc. included. The corresponding figure for a normal conducting structure (1207.5 MHz, on axis coupled) is 104.6 M$.

5710 (SLAC-PUB–5126) **GENI: A graphical environment for model-based control.** Kleban, S.; Lee, M.; Zambre, Y. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Oct 1989. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-891094–5: International conference on accelerator and large experimental physics control systems, Vancouver (Canada), 30 Oct - 3 nov 1989). Order Number DE90004431. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A new method to operate machine and beam simulation programs for accelerator control has been developed. Existing methods, although cumbersome, have been used in control systems for commissioning and operation of many machines. We developed GENI, a generalized graphical interface to these programs for model-based control. This "object-oriented"-like environment is described and some typical applications are presented. 4 refs., 5 figs.

4302 Beam Dynamics, Field Calculations, and Ion Optics

Refer also to citation(s) 5678, 5723, 5724, 5912, 6054, 6442, 6443

5711 (ANL-HEP-CP–89-67) **Report from the polarization group of the Fermilab Injector workshop.** Berger, E. (Argonne National Lab., IL (USA)); Glass, G.; Imai, K.; Jones, L.; Lin, A.M.T.; Mane, S.R.; Meschanin, A.; Onel, Y.; Roberts, J.; Hsueh, S.; Teng, L.; Underwood, D.; Vasiliev, A. Argonne National Lab., IL (USA). 20 Jul 1989. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-8006286–1: Workshop on scintillating fiber detector development for the SSC, Batavia, IL (USA), 11-16 Jun 1980). Order Number DE90002209. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The group considered physics, accelerator, and polarized source issues. Most of the physics study was concerned with what significant and unique experiments could be done if polarized protons could be accelerated in the main injector and eventually in the Tevatron. 12 refs., 4 figs.

5712 (CONF-890335–271) **A five-picosecond electron pulse from ANL (Argonne National Laboratory) L-Band Linac.** Cox, G.L.; Jonah, C.D.; Ficht, D.T.; Mavrogenes, G.S.; Sauer, M.C. Jr. Argonne National Lab., IL (USA). [1989]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 13. particle accelerator conference; Chicago, IL (USA); 20-23 Mar 1989. Order Number DE90003821. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The pulse-compression system of the Argonne National Laboratory Chemistry Division L-Band Linac, presented at the 1986 Linear Accelerator Conference at Stanford, California, has been completed. A five-picosecond-wide electron pulse containing 6×10^{-9} coulomb charge has been achieved. Acceleration parameters and the pulse-width measurement technique are discussed, and future plans for the utilization of this pulse in radiation chemistry studies are presented. 5 refs., 4 figs.

5713 (INIS-BR–1692, pp. 180-189) **Monte Carlo calculations of X^- for high-energy X rays.** Sibata, C.H. (Cleveland CLinic Foundation, OH (USA). Dept. of Radiation Therapy); Mota, H.C. Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. (CONF-8908184–: 3. meeting of the Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). In *Proceedings of the 3. Brazilian Congress of Physicists in Medicine*. Order Number DE90705978. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The present work reports calculations done for 1.25, 2.5, 3.1, 4.5 e 6.0 MeV brood monoenergetic X-rays beam perpendicularly incident in water and polyestyrene phantoms, taking into account photon scattering effects, using the EGS Monte Carlo code version 4. (author).

5714 (SLAC/AP–77) **Canonical formalism for coupled beam optics.** Kheifets, S.A. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Sep 1989. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. Order Number DE90003764. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Beam optics of a lattice with an inter-plane coupling is treated using canonical Hamiltonian formalism. The method developed is equally applicable both to a circular (periodic) machine and to an open transport line. A solution of the equation of a particle motion (and correspondingly transfer matrix between two arbitrary points of the lattice) are described in terms of two amplitude functions (and

their derivatives and corresponding phases of oscillations) and four coupling functions, defined by a solution of the system of the first-order nonlinear differential equations derived in the paper. Thus total number of independent parameters is equal to ten. 8 refs.

5715 (SLAC-CN-372) **The relation of electrode voltages to charge position in SLC arc and final focus beam position monitors.** Fordham, C. Stanford Linear Accelerator Center, Menlo Park, CA (USA). 2 Nov 1989. 42p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. Order Number DE90003763. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The position of a charged particle beam can be measured with a Beam Position Monitor (BPM) by converting the voltages induced on its array of electrodes into a position offset from the array's center. Most of the BPMs in the Arcs and Final Focus of the SLC use four stripline electrodes arranged symmetrically around the beam; normalized voltage differences are calculated as the difference divided by the sum of voltages on opposite electrode pairs. The resulting number is multiplied by a conversion factor, denoted in this paper as S_b, to give the offset (in millimeters) of the charge from the center of the BPM. Prior to installation in the beam line, the BPMs were calibrated with a charge pulse on a rod. Owing to geometric effects which will be discussed later, a different conversion factor had to be used for calibration. It will be denoted here by S_r. This paper gives the results of calculations and measurements of S_r and S_b for Arc and Final Focus BPMs. This paper also describes the relevant physical properties of the several types of BPMs and calculations of the expected scale factors, the measurement methods used, and gives the results of measurements, which are compared with the theoretical expectations. 2 refs., 18 figs., 7 tabs.

5716 **Studies of induced radioactivity at the AGS.** Brown, K.A. (AGS Dept., Brookhaven National Lab., Associated Univs., Inc., Upton, NY); Tanaka, M. pp. 2030 of Proceedings of the 1987 IEEE particle accelerator conference: Accelerator engineering and technology. Lindstrom, E.R.; Taylor, L.S IEEE Service Center, Piscataway, NJ (1987). (CONF-870302–: Particle accelerator conference, Washington, DC (USA), 16-19 Mar 1987).

With the goals of higher proton intensities, along with the many modes the AGS now runs and those being commissioned to run, the authors have begun detailed studies of the beam induced radioactivity in the AGS.

5717 **The Brookhaven Radiation Effects Facility.** Grand, P. (Brookhaven National Lab., Upton, NY (USA)); Snead, C.L.; Ward, T.E. *Nuclear Instruments and Methods in Physics Research, Section B: Beam Interactions with Materials and Atoms (Netherlands)*, 42(2): 277-280 (Jun 1989).

A Neutral Particle Beam (NPB) Radiation Effects Facility (REF), funded by the Strategic Defense Initiative Office (SDIO), has been constructed at Brookhaven National Laboratory (BNL). Operation started in October 1986. The facility is capable of delivering pulsed H^-, H^0, and H^+ beams of 100 to 200 MeV energy up to 30 mA peak current. Pulses can be adjusted from 50 ns to 500 μs length at a repetition rate of 5 pps. The beam spot on target is adjustable from 3 to 100 cm diameter (2σ) resulting in a maximum dose of about 5 MRads (Si) per pulse (small beam spot). Experimental use of the REF is being primarily supported by the SDI lethality program. The program has addressed ionization effects in electronics, both dose rate and total dose dependence, radiation-sensitive components, and dE/dx effects in energetic materials including propellants and high explosives (HE). This paper describes the facility and its capabilities. (orig.).

4303 Auxiliaries and Components

Refer also to citation(s) 6442, 6443

5718 (BNL–43066) **Programs for control of an analog-signal switching network.** D'Ottavio, T.; Enriquez, R.; Katz, R.; Skelly, J. Brookhaven National Lab., Upton, NY (USA). 1989. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-891094–4: International conference on accelerator and large experimental physics control systems, Vancouver (Canada), 30 Oct - 3 nov 1989). Order Number DE90003645. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A suite of programs has been developed to control the network of analog-signal switching multiplexers in the AGS complex. The software is driven by a relational database which describes the architecture of the multiplexer tree and the set of available analog signals. Signals are routed through a three-layer multiplexer tree, to be made available at four consoles each with three 4-trace oscilloscopes. A menu-structured operator interface program is available at each console, to accept requests to route any available analog signal to any of that console's 12 oscilloscope traces. A common routing-server program provides automatic routing-server program provides automatic routing of requested signals through the layers of multiplexers, maintaining a reservation database to denote free and in-use trunks. Expansion of the analog signal system is easily accommodated in software by adding new signals, trunks, multiplexers, or consoles to the database. Programmatic control of the triggering signals for each of the oscilloscopes is also provided. 3 refs., 4 figs., 3 tabs.

5719 (INFN-AE–89-2) **Strategies for filling the longitudinal phase space in the injection into a booster proton synchrotron at very high intensity currents.** Leo, M. (Istituto Nazionale di Fisica Nucleare, Lecce (Italy)); Leo, R.A.; Mancarella, G.; Soliani, G.; Pusterla, M. Istituto Nazionale di Fisica Nucleare, Rome (Italy). 1989. 48p. Order Number DE90610939. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A theory of the longitudinal painting in high intensity circular proton synchrotron accelerators is developed. The study of the uniform filling of a limited region of the booster phase space (x, y) and a uniform line density on a finite intervall of the x-axis is achieved by describing the particle beam behaviour via the Vlasov equation with no space charge forces. Analytical painting laws are found for both the cases of small oscillations and pendulum-like motion.

5720 (INFN-LNF–89-018(R)) **RF test of a 6 GHz superconducting cavity at LNF.** Boni, R. (Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Lab. Nazionale di Frascati); Savoia, B.; Tozzioli, F.; Fabbricatore, P.; Parodi, R.; Fernandes, P. Istituto Nazionale di Fisica Nucleare, Rome (Italy). 1989. 14p. Order Number DE90610941. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

RF tests of a 6 GHz Superconducting Cavity made of bulk niobium and working in a high order transverse electric mode (TE_{118}), have been carried out at LNF to measure the maximum achievable RF fields and to investigate the possibility of using it as a microwave undulator. The results obtained in this work and the experience gained in the field of Superconducting Radiofrequency are reported in this paper.

5721 (LA-UR–89-3615) **Radiation effects at a high power accelerator and applications to advanced energy sources.** Sommer, W.F. (Los Alamos National Lab., NM (USA)); Garner, F.A.; Brown, R.D.; Wechsler, M.S. Los Alamos National Lab., NM (USA). [1989]. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-891204–2: 4. international conference on fusion reactor materials, Kyoto (Japan), 4-8 Dec 1989). Order Number DE90002418. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Many materials are exposed to atom-displacing radiation at high-power accelerators such as the Los Alamos Meson Physics Facility (LAMPF). Beam current densities in the 800-MeV proton beam vary from 12.5 mA cm^{-2} (8×10^{16} p/cm^2s) on graphite targets to 20-μA cm^{-2} (1.3×10^{14} p/cm^2s) on metal-alloy windows. High-level radiation damage results from these particle fluxes. As a consequence of secondary-particle generation in targets and windows and low-level beam losses that lead to particle interactions with structural material, various components are exposed to low-level proton fluxes, gamma radiation, and neutron fluxes of 10^6–10^{10} n/cm^2s. These include vacuum seals and vacuum chambers of stainless steel and aluminum alloys, solid-state devices for control, diagnostic, and data acquisition electronics, closed-loop cooling-water systems, and insulators. Properties of these materials are degraded by the radiation exposure. Studies of LAMPF and other accelerators, however, have produced solutions to materials problems, allowing the machines to

operate for acceptable times without failure. Nevertheless, additional improvements are being investigated in order to further improve operational reliability and safety. 25 refs., 3 figs., 3 tabs.

5722 (SLAC-PUB-5073) **Superconducting magnets in high radiation environments: Design problems and solutions.** St. Lorant, S.J.; Tillmann, E. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Nov 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890850-5: 11. international conference on magnet technology, Tsukuba (Japan), 28 Aug - 1 sep 1989). Order Number DE90004427. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

As part of the Stanford Linear Collider Project, three high-field superconducting solenoid magnets are used to rotate the spin direction of a polarized electron beam. The magnets are installed in a high-radiation environment, where they will receive a dose of approximately 10^3 rad per hour, or 10^8 rad over their lifetimes. This level of radiation and the location in which the magnets are installed, some 10 meters below ground in contiguous tunnels, required careful selection of materials for the construction of the solenoids and their ancillary cryogenic equipment, as well as the development of compatible component designs. This paper describes the materials used and the design of the equipment appropriate for the application. Included are summaries of the physical and mechanical properties of the materials and how they behave when irradiated. 16 refs., 7 figs., 1 tab.

5723 **AGS booster prototype magnets.** Danby, G. (Brookhaven Nat. Lab., Upton, NY); Jackson, J.; Lee, Y.Y.; Phillips, R.; Brodowski, J.; Jablonski, E.; Keohane, G.; McDowell, B.; Rodger, E. pp. 2030 of Proceedings of the 1987 IEEE particle accelerator conference: Accelerator engineering and technology. Lindstrom, E.R.; Taylor, L.S IEEE Service Center, Piscataway, NJ (1987). (CONF-870302-: Particle accelerator conference, Washington, DC (USA), 16-19 Mar 1987).

Prototype magnets have been designed and constructed for two half cells of the AGS Booster. The lattice requires 2.4m long dipoles, each curved by 10^0. The multi-use Booster injector requires several very different standard magnet cycles, capable of instantaneous interchange using computer control from dc up to 10 Hz.

5724 **Design of achromatic bending systems in the presence of space charge.** Jason, A.J. (Los Alamos Nat. Lab., Los Alamos, NM); Svaton, E.M.; Blind, B.; Heighway, E.A. pp. 2030 of Proceedings of the 1987 IEEE particle accelerator conference: Accelerator engineering and technology. Lindstrom, E.R.; Taylor, L.S IEEE Service Center, Piscataway, NJ (1987). (CONF-870302-: Particle accelerator conference, Washington, DC (USA), 16-19 Mar 1987).

The usual conditions for achromaticity of a dispersive system are shown to be inadequate when space-charge effects are included. Using a matrix formulation describing linear space-charge forces, the authors give generalized criteria necessary for a system to be achromatic. Additionally, these conditions are necessary for conservation of transverse emittances. An example of such a system is given.

5725 **POS - a 1D time-dependent H^+ ion source code.** Glasser, A.H. (Los Alamos National Lab., NM (USA)); Smith, K. *Computer Physics Communications (Netherlands),* 55(3): 409-424 (Oct 1989).

Cray X-MP; FORTRAN 77.

The code POS is based on the first three velocity moment's expansion of the transport equation, as derived in Braginskii's theory for two fully ionized fluids, H^+ and e. The theory requires the solution of four (plasma density, drift velocity, electron and ion temperatures) coupled, time-dependent equations. These equations have been solved in one spatial dimension using the method of moving finite elements. (orig.).

4304 Storage Rings

5726 (CONF-890803-42) **Dynamic aperture measurement on Aladdin.** Bridges, J. (Argonne National Lab., IL (USA)); Cho, Y.; Chou, W.; Crosbie, E.; Kramer, S.; Kustom, R.; Voss, D.; Teng, L.; Kleman, K.; Otte, R.; Trzeciak, W.; Symon, K. Argonne National Lab., IL (USA). [1989]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From International conference on high energy accelerators; Tsukuba (Japan); 20-26 Aug 1989. Order Number DE90003797. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The sextupole-induced non-linear transverse beam dynamics in the synchrotron radiation storage ring Aladdin is studied. Specifically, the dynamic aperture is measured as function of the sextupole strength. The results agree reasonably well with computer simulations. 1 ref., 8 figs., 1 tab.

5727 (CONF-8910201-2) **The radio frequency accelerating system of the APS [Advanced Photon Source] at Argonne.** Nicholls, G.L.; Bridges, J.; Smith, T.; Voss, D. Argonne National Lab., IL (USA). [1989]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 2. All-Union workshop on new methods of particle acceleration; Noramberd (USSR); 10-14 Oct 1989. Order Number DE90003766. Available from NTIS, PC A02/MF A01; OSTI; INIS.

Argonne National Laboratory is constructing a 7-GeV Advanced Photon Source (APS). The RF systems of the APS include 10-MHz and 120-MHz systems for the Positron Accumulator Ring (PAR), a multicell 352-MHz system for the booster synchrotron, and a system of mode-damped, single-cell 352-MHz cavities for the storage ring. 11 refs., 3 figs., 6 tabs.

5728 (DOE/FTR-90002951) **[Manufacturing the dipole magnets for the HERA Project at DESY]: Foreign trip report, October 11, 1989-October 24, 1989.** Goodzeit, C.L. Brookhaven National Lab., Upton, NY (USA). 25 Oct 1989. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90002951. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report summarizes the visit made to Ansaldo in Genoa to observe the final phase of the production of the cold masses for the DESY HERA dipole magnets. After this, I attended the 10th Workshop on the INFN Eloisatron Project dealing with new techniques for future accelerators and high intensity storage rings also dealing with the status and prospects for superconducting accelerator magnets. A review of this workshop is also presented.

5729 (INFN-LNF-89-044(R)) **Superconducting wiggler for ADONE: First tests and results.** Barone, M. (Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Lab. Nazionale di Frascati); Cattoni, A.; Sanelli, C. Istituto Nazionale di Fisica Nucleare, Rome (Italy). 1989. 9p. Order Number DE90610948. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

A superconducting wiggler magnet has been successfully tested at ANSALDO COMPONENTI works. The design field of 6 Tesla has been reached after limited training. The field of 6.025 +- 0.003 Tesla has been measured by means of a flip coil connected to an integrating magnetometer. Field profile measurements were made at 5.0, 5.75 and 6.025 Tesla, during which time, the magnet showed high stability. The overall cryogenic losses have been measured and they are consistent with the computed ones. 24 refs.

5730 (UCID-21819) **An injection system for PEP-based asymmetric storage ring collider for the copious production of B mesons.** Barletta, W.A. Lawrence Livermore National Lab., CA (USA). 18 Sep 1989. 23p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90004443. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The proposed asymmetric energy B-factory utilizing PEP will require high energy, low emittance sources of positrons and electrons suitable for filling the storage rings. Proposed characteristics of this collider operating at a luminosity of 10^{34} $cm^{-2}s^{-1}$ have been studied by LBL (Apiary-III). The design consists of two rings, a large 9 GeV ring (PEP or a modification thereof) plus a smaller 3.1 GeV ring, each with a circulating current of 3 Amperes. Ideally the fill time should be much shorter than the luminosity life-time of the rings (set by the size of the low energy ring). As the luminosity lifetime of the collider is not expected to be very high, the PEP-based B-factory should have a powerful, dedicated injector. For the purpose of estimating the characteristics of the injection system the maximum time for a complete fill of the positron ring is taken to be

≈100 seconds. The design of the injection system is discussed in this paper. 1 ref., 9 figs., 4 tabs.

44 INSTRUMENTATION

Refer also to citation(s) 5909

4401 Radiation Instrumentation

Refer also to citation(s) 4904, 5027, 5176, 5514, 5544, 5545, 5546, 5547, 5550, 6051, 6052, 6102, 6112, 6138, 6193, 6199, 6204

5731 (BONN-IR–89-14) **Measurement of the positron-drift time relation of a high-pressure drift chamber.** Pruefert, W. Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet. Apr 1989. 39p. (In German). Order Number DE90728786. Available from NTIS (US Sales Only), PC A03/MF A01.

As a test of its performance, the measurement of the drift time versus drift distance relation of a high pressure drift chamber using cosmic rays is described. Two multiwire proportional chambers, mounted above and below the detector, are used to define the track of the cosmic particle in the drift chamber. The drift chamber is read out by FADCs (Flash Analog to Digital Converter), and the drift time is determined from the FADC signals by the DOS- (Difference Of Samples) method. The measured drift time versus drift distance relation showed good agreement with the relation, which is expected from the spatial dependence of the electric field and the dependence of the drift velocity on this field. (orig.).

5732 (CEGB-RD/B–6101/R88) **Response of film badge dosemeters to high energy photon radiation.** Playle, T.S. Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs. Dec 1988. 7p. Order Number DE90610215. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The sites of the earlier magnox reactor power stations at Berkeley and Bradwell in the United Kingdom are subject to 6 MeV photon radiation from the coolant gas. Since 1966 the Central Electricity Generating Board has included in its film badge personal dosimetry procedures an algorithm for applying a correction for over-response to high energy photon radiation. The correction is based on laboratory irradiations using a source of pure 6 MeV photon radiation. Recently, the opportunity arose to evaluate the response of the film badges at locations around the Berkeley reactors where spectrum-dependent dose equivalent rates had been measured. This report compares the response of the film badge in these characterised radiation environments with the response measured in the calibration laboratory. It is concluded that in the location where measurements were made, the high energy enhancement of measured dose was obscured by the effects of low energy scattered radiation, and it is considered that this will be the case for all practical situations on the power station site. There is therefore no advantage in using the 6 MeV correction factors for routine film badge dosimetry in these locations. (author).

5733 (CEGB-TPRD/B–0867/R88) **Extrapolation ionisation chamber measurements on beta-emitting sources produced for the CEGB collaborative radiobiology programme.** Wells, J. Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs. Aug 1988. 21p. Order Number DE90610216. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This report describes the structure and application of an extrapolation ionisation chamber used for measuring dose-rates from plane and point beta-emitting sources. These measurements form the basis of the dosimetry for a collaborative radiobiological study of skin to study both stochastic and non-stochastic effects. A small sample from the wide range of measurements undertaken in the programme has been selected to illustrate the procedures involved. The extrapolation chamber is currently being automated and it is intended that this report should provide a source reference to the basis of the measurements made between 1977-86. (author).

5734 (CONF-891044–3) **Radioactive nuclear beams from the Argonne Fragment Mass Analyzer.** Davids, C.N. Argonne National Lab., IL (USA). [1989]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 1. international conference on radioactive nuclear beams; Berkeley, CA (USA); 16-18 Oct 1989. Order Number DE90003810. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A brief description is given of the Fragment Mass Analyzer (FMA), currently under construction at the ATLAS facility of Argonne National Laboratory. After a discussion of the general ion-optical properties of the FMA, the specific ion optics to be used for the extraction of radioactive nuclear beams are presented. 4 refs., 6 figs., 1 tab.

5735 (CONF-891087–11) **A fast large-area position-sensitive time-of-flight neutron detection system.** Crawford, R.K.; Haumann, J.R. Argonne National Lab., IL (USA). 13 Oct 1989. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From IEEE nuclear science symposium and exhibits; San Francisco, CA (USA); 25-27 Oct 1989. Order Number DE90003815. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A new position-sensitive time-of-flight neutron detection and histograming system has been developed for use at the Intense Pulsed Neutron Source. Spatial resolution of roughly 1 cm x 1 cm and time-of-flight resolution of ~1 μsec are combined in a detection system which can ultimately be expanded to cover several square meters of active detector area. This system is based on the use of arrays of cylindrical one-dimensional position-sensitive proportional counters, and is capable of collecting the x-y-t data and sorting them into histograms at time-averaged data rates up to ~300,000 events/sec over the full detector area and with instantaneous data rates up to more than fifty times that. Numerous hardware features have been incorporated to facilitate initial tuning of the position encoding, absolute calibration of the encoded positions, and automatic testing for drifts. 7 refs., 11 figs., 1 tabs.

5736 (DOE/ER/03956–8) **Elementary particle interactions: Progress report, October 1, 1988–November 15, 1989.** Bugg, W.M.; Condo, G.T.; Handler, T.; Hart, E.L.; Ward, B.F.L.; Close, F.E. Tennessee Univ., Knoxville, TN (USA). Dept. of Physics. [1989]. 63p. Sponsored by U.S. DOE Energy Research. DOE Contract AS05-76ER03956. Order Number DE90003729. Available from NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

Some topics discussed in this report are: data analysis; SLAC photoproduction; preparation for experiments; SLD at SLC; the LM-SAT /MASC in the SLD software; beam test at Brookhaven National Laboratory; SSC Detector Research and Development; and liquid media for SSC colorimeters.

5737 (DOE/ER/40039–25) **Experimental high energy physics program at Texas A and M University: Annual progress report, April 1, 1989–March 31, 1990.** Webb, R.C. (Texas A and M Univ., College Station, TX (USA). Dept. of Physics). Texas A and M Univ., College Station, TX (USA). Research Foundation. Dec 1989. 106p. Sponsored by U.S. DOE Energy Research. DOE Contract AS05-81ER40039. Order Number DE90003728. Available from NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.

During the past twelve months our group has continued to reach new milestones in our various research initiatives. One of our major accomplishments was our group's participation in the successful high luminosity data taking run with the CDF detector. Over the course of this 12 month run the collaboration recorded a record $4.7 pb^{-1}$ onto data tape. It is evident from the papers which are starting to appear in the literature based on this data, that these results will have a strong impact on our understanding of the physics at cm energies of 2 TeV. In addition to these CDF activities, our group also participated in the commissioning and operation of the first supermodule of the MACRO detector at the Gran Sasso Laboratory in L'Aquila, Italy. This detector was operated for approximately 3 months during the spring of 1989, and has recently been brought back on line after a summer shutdown. The results from the data taken with this first module indicate that the MACRO experiment is also destined to make a significant contribution to our understanding of the origin and nature of several interesting high energy cosmic ray phenomenon. Lastly, our group has begun to devote some of its attention toward the subject of carrying our experiments at the SSC. During the past year, we began a study of the suitability of liquid scintillator for calorimetry at the SSC and an investigation into the development of new detector technology for use

as a tracking chamber of SSC experiments. In the accompanying report we will present the details of these and other accomplishments which have been achieved this year and outline our group's plan for its continued participation in these research programs.

5738 (DOE/ER/40039–31) **First results from the MACRO [Monopole, Astophysics, Cosmic Ray Observatory] detector at the Gran Sasso Laboratory.** Calicchio, M.; De Cataldo, G.; De Marzo, C.; Erriquez, O.; Favuzzi, C.; Giglietto, N.; Nappi, E.; Spinelli, P.; Cecchini, S.; D'Antone, I.; Giacomelli, G.; Mandrioli, G.; Margiotta-Neri, A.; Matteuzzi, P.; Pal, B.; Patrizii, L.; Predieri, F.; Sanzani, G.L.MACRO Collaboration. Texas A and M Univ., College Station, TX (USA). Dept. of Physics. [1989]. 21p. Sponsored by U.S. DOE Energy Research. DOE Contract AS05-81ER40039. (CONF-890930–3: 2. international conference on engineering management, Toronto (Canada), 10-13 Sep 1989). Order Number DE90003243. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The MACRO (Monopole, Astrophysics, Cosmic Ray Observatory) detector which is being installed at the underground Gran Sasso Laboratory (LNGS) is described in detail. The performance of the detector's first supermodule (~800 m^2sr), which had its initial data run from February 27 to May 30, 1989, is reported. About 245,000 muon triggers were recorded during this first run. Preliminary results are presented on: the measured vertical muon flux; the detection features of MACRO as a high energy muon and muon neutrino telescope; the measured lateral spread and multiplicity distributions of muon bundles; a search for GUT magnetic monopoles; a search for electron anti-neutrinos from stellar collapses. In addition, there are results obtained in conjunction with the EAS-TOP detector located on top of the Gran Sasso mountain. 24 refs., 22 figs.

5739 (DOE/FTR–90002425) **[Recent progress in development of high-rate, position sensitive, x-ray detectors at Brookhaven]: Foreign trip report, September 30, 1989–October 11, 1989.** Smith, G.C. Brookhaven National Lab., Upton, NY (USA). 24 Oct 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90002425. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

At the 2nd European Conference on Progress in X-ray Synchrotron Radiation Research, I presented a paper entitled "Recent Progress in Development of High Rate, Position Sensitive, X-ray Detectors at Brookhaven" and discussed the current status and future plans of x-ray detector development with colleagues from most of the European synchrotron radiation facilities. At Leicester University, England, I had a detailed discussion with my theoretical collaborator on methods which we are jointly investigating to substantially reduce position modulation from multiwire proportional chambers. We discussed some related problems in particle and heavy ion "pad" detectors.

5740 (IAEA-TECDOC–520, pp. 25-32) **Examples of benefits using radioisotope sources in analyzers for on-line process control in mineral processing.** Hietala, M. (Outokumpu Electronics, Espoo (Finland)). International Atomic Energy Agency, Vienna (Austria). Aug 1989. (CONF-8810450–: Advisory group on technical and economic benefits of nuclear techniques in ore processing, Krakow (Poland), 24-28 Oct 1988). In *Technical and economic benefits of nuclear techniques in ore processing. Report of an advisory group meeting held in Krakow, Poland, 24-28 October 1988.* Order Number DE90607841. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Economical applications of radioisotope based on-line process analyzers are described in iron ore and zinc ore concentrator, in copper flash smelting process and in cement manufacturing. A short description of analyzers used is included. (author). 6 refs.

5741 (IAEA-TECDOC–530) **Nuclear electronics laboratory manual 1989 edition.** International Atomic Energy Agency, Vienna (Austria). Oct 1989. 326p. Order Number DE90610214. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

This manual is a joint product of several electronics experts who have been associated with IAEA activity in this field for many years. It is based on the experience of conducting twenty-three training courses on nuclear electronics. Compared with the first edition, published 1984, this edition contains many new experiments, mainly on the advanced technical level. The total number of experiments and special projects is 58. Tabs and figs.

5742 (INIS-BR–1692, pp. 61-69) **Performance of special extremity dosemeters of BeO in fields of X and gamma radiation.** Caldas, L.V.E. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)); Graf, W.; Brand, H.-N. Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. (In Portuguese). (CONF-8908184–: 3. meeting of the Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). In *Proceedings of the 3. Brazilian Congress of Physicists in Medicine.* Order Number DE90705978. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

A dosimetric system, with a thermoluminescent reproducer and BeO dosemeters incorporated in a discardly metallic support, for using in extremities is tested, in relation theirs mains characteritics: determination of the detectable minimum expousure, linearity of the response of ^{60}Co radiation, thermal fading at 50^{0}C and energetic dependence for X-radiation and gamma. (C.G.C.).

5743 (INIS-BR–1692, pp. 70-82) **Correction factors for clinical dosemeters used in dosimetry of large fields.** Campos, L.L. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)); Caldas, L.V.E. Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. (In Portuguese). (CONF-8908184–: 3. meeting of the Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). In *Proceedings of the 3. Brazilian Congress of Physicists in Medicine.* Order Number DE90705978. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

A method for using by physicist for evaluation of irradiation effect in cables connectors of ionization chambers, and the consequent determination of adequate conection factors, for each measure the geometric system, during the realization of large fields radiation dosimetry are studied. (C.G.C.).

5744 (INIS-BR–1692, pp. 36-44) **Angular dependence of IPEN parallels plates ionization chambers.** Albuquerque, M. da P. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)); Caldas, L.V.E. Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. (In Portuguese). (CONF-8908184–: 3. meeting of the Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). In *Proceedings of the 3. Brazilian Congress of Physicists in Medicine.* Order Number DE90705978. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The angular dependence of parallel plates ionization chambers for X-radiation of low energy is studied, aiming at the correction of any influence that may occur, due to positioning. The national fabrication chambers behaviour is evaluated and the results are compared with imported similar chambers. (C.G.C.).

5745 (INIS-BR–1692, pp. 45-60) **Utilization of glasses as radiation detectors for high doses.** Caldas, L.V.E. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. (In Portuguese). (CONF-8908184–: 3. meeting of the Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). In *Proceedings of the 3. Brazilian Congress of Physicists in Medicine.* Order Number DE90705978. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

Samples of specials glasses for using in dosimetry of high exposure are studied. Their main characteristics are determinated: detectable minimum exposure, reproducibility and linearity of its response to ^{137}Cs gamma radiation, by optical absorption measure technic and thermoluminescence. (C.G.C.).

5746 (INIS-BR–1692, pp. 161-170) **Computational analysis for electrect ionization chambers in the detection and dosimetry of thermal neutrons.** Ghilardi, A.J.P. (Sao Paulo Univ., SP (Brazil)); Pela, C.A.; Paula, E. de; Ghilardi Netto, T.; Zimmerman, R.L. Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. (In Portuguese). (CONF-8908184–: 3. meeting of the Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). In *Proceedings of the 3. Brazilian*

Congress of Physicists in Medicine. Order Number DE90705978. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

A numerical analysis of the electret ionization chambers response for detecting thermal neutrons is done. (author).

5747 (INIS-BR–1692, pp. 171-179) **Image processor for high resolution video.** Pessoa, P.P. (Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil)); Assis, J.T.; Cardoso, S.B.; Lopes, R.T. Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. (In Portuguese). (CONF-8908184–: 3. meeting of the Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). In *Proceedings of the 3. Brazilian Congress of Physicists in Medicine*. Order Number DE90705978. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

In this paper, we discuss an image presentation and processing system developed in Turbo Pascal 5.0 Language. Our system allows the visualization and processing of images in 16 different colors, taken at a time from a set of 64 possible ones. Digital filters of the mean, mediam Laplacian, gradient and histograms equalization type have been implemented, so as to allow a better image quality. Possible applications of our system are also discussed e.g., satellites, computerized tomography, medicine, microscopes. (author).

5748 (INIS-BR–1692, pp. 201-206) **Correction of exposure time for a high activity Co-60 unit.** Tannous, A. (Instituto de Cancer de Londrina, (Brazil). Radioterapia); Silva, M.A. da. Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. (In Portuguese). (CONF-8908184–: 3. meeting of the Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). In *Proceedings of the 3. Brazilian Congress of Physicists in Medicine*. Order Number DE90705978. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

This work evaluates the importance of the spent time of a Cobalt-60 unit and proposes corrections for the exposure time of the Theratron 780, when the dosimetric parameter used for the source yield is fixed in CGy/min. (author).

5749 (INIS-BR–1692, pp. 253-261) **Utilization of commercial photodiode BPW-34 in interface dosimetry.** Khoury, H. (Pernambuco Univ., Recife (Brazil). Dept. de Energia Nuclear); Lopes, F.; Melo, F. de A.; Freitas, L.C. Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. (In Portuguese). (CONF-8908184–: 3. meeting of the Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). In *Proceedings of the 3. Brazilian Congress of Physicists in Medicine*. Order Number DE90705978. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

Aiming to develop a semiconductor dosemeter for substituting the parallel plates ionization chambers, some studies were done using the photodiode BPW-34. (author).

5750 (INIS-BR–1692, pp. 207-208) **Maintenance of thumb ionization chambers.** Torres, R.P. (Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil). Area IV); Teixeira, D.L.; Cardoso, D.D.; Teixeira e Silva, E. Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. (In Portuguese). (CONF-8908184–: 3. meeting of the Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). In *Proceedings of the 3. Brazilian Congress of Physicists in Medicine*. Order Number DE90705978. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

Published in summary form only. IONIZATION CHAMBERS/ performance; PERFORMANCE; RADIOTHERAPY

5751 (INIS-BR–1692, pp. 218-227) **Comparison of radiographic technique by computer simulation.** Brochi, M.A.C. (Sao Paulo Univ., Ribeirao Preto, SP (Brazil). Faculdade de Filosofia, Ciencias e Letras); Ghilardi Neto, T. Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. (In Portuguese). (CONF-8908184–: 3. meeting of the Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). In *Proceedings of the 3. Brazilian Congress of Physicists in Medicine*. Order Number DE90705978. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

A computational algorithm to compare radiographic techniques (KVp, mAs and filters) is developed based in the fixation of parameters that defines the images, such as optical density and constrast. Before the experience, the results were used in a radiography of thorax. (author).

5752 (INIS-BR–1692, pp. 228-240) **Development of a system to evaluate the bone mineral content.** Gariba, M.A. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Robilotta, C.C.; Costa, P.R. Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. (In Portuguese). (CONF-8908184–: 3. meeting of the Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). In *Proceedings of the 3. Brazilian Congress of Physicists in Medicine*. Order Number DE90705978. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

Among different techniques available to quantify bone mineral content, we have decided to work with that one based on single photon absorptiometry (SPA). Tests using aluminium simulator and sheep bones have been done to asure a good performance of our device. (author).

5753 (INIS-BR–1694) **Measures 'in situ' of suspendent sediment concentration. Development of an instrument based on the principle of gamma radiation transmission.** Bandeira, J.V.; Aun, P.E. Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte, MG (Brazil). 1989. 11p. (In Portuguese). (CONF-8908187–: 2. state meeting of new materials and 1. Florida-Brazil seminar on materials, Rio de Janeiro (Brazil), 2-4 Aug 1989). Order Number DE90610294. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The concentration of suspended sediment in water bodies can be determined by an instrument based on the transmission of gamma radiation through matter. The equipment, immerged in the measuring volume, is basically constituted by a source of gamma radiation and a detector kept at a defined distance. The paper presents the physical principles on which the instrument is based and discusses the influence of the radiation energy and of material composition in the measurement's results. It also presents the calibration method and the results obtained during the experiments, that used two sediments of different origin.

5754 (INIS-BR–1751) **Utilization of glasses as radiation detectors for high doses.** Caldas, L.V.E. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)). Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. 1p. (In Portuguese). (CONF-8908184–: 3. meeting of the Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). Order Number DE90610217. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. RADIATION DETECTORS/ glass; RADIATION DETECTORS/radiation doses; RADIATION DETECTORS/thermoluminescence; CESIUM 137; GLASS; THERMOLUMINESCENCE

5755 (INIS-BR–1756) **Reading values of X-ray diffractogram with a digitalizar help.** Vaquera, A.; Oliveira, N.P. de. Para Univ., Belem, PA (Brazil). Centro de Geociencias. 1985. 7p. (In Portuguese). (CONF-8512160–: 2. symposium of amazon geology, Belem (Brazil), 1-9 Dec 1985). Order Number DE90608813. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Accuracy of responses obtained through the sketch of deflection peaks in a determined position of the X-ray diffractogram, with hight rotation velocity of the goniometer, is attained with detriment of the resolution. However, the use of a HP 9836A digitalizer connected to HP 9830A minicomputer minimizes reading errors, with the advantage of being faster and nome accurate and precise. Knowing the diffractogram extreme reading values or 'Ad'amplitude (in Θ degrees), it possible to determine the diffratogram angular distance and the distances between the peaks and the diffratogram origin. These values can be expressed in deflection terms in amgstrons througg Bragg equation. Precision also depends upon the position of the diffratogram in relation to the coordenates established in the digitalizer table. This problem ca be prevented calculating individual distances from each peak to the origin and end of the diffractogram, considering a fixed point on digitalizer table as coordinates of origin, what, however it demands a rather longer response time. The

method also permits the utilization of an internal standard, in order to determine the distances in relation to the known position of a peak starting from its correspondent deflection value. It is possible to identify the minerals of the analized sample, stocking the deflection values of values of main natural minerals in the minicomputer memory.

5756 (INIS-mf–11562, pp. 2) **Energy dependence of personnel thermoluminescence gamma detectors.** Antol, M. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. THERMOLUMINESCENT DOSEMETERS/energy dependence; GAMMA DOSIMETRY; PERSONNEL DOSIMETRY; PHOSPHATE GLASS

5757 (INIS-mf–11562, pp. 22) **Determination of mass calibration factor of ionization chambers.** Horakova, I. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Radiologicke Dozimetrie). Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. IONIZATION CHAMBERS/calibration; ATTENUATION; GRAPHITE; CALIBRATION; NYLON; PLEXIGLAS; SCATTERING; TEFLON

5758 (INIS-mf–11562, pp. 77) **Thermoluminescence dosimetry monitoring of external irradiation on Czechoslovak territory.** Sujak, P. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni); Matusu, J.; Bucina, I. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. RADIATION MONITORING/thermoluminescent dosimetry; EXTERNAL IRRADIATION; RADIATION DOSES; RADIATION MONITORS

5759 (INIS-mf–11562, pp. 84) **Effect of etching procedure on detection properties of electrochemically etched neutron detector.** Turek, K. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni); Pinak, M. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. DIELECTRIC TRACK DETECTORS/etching; NEUTRON DETECTORS/dielectric track detectors; BACKGROUND NOISE; ETCHING; NEUTRON FLUENCE; RADIATION DOSES; SENSITIVITY

5760 (INIS-mf–11562, pp. 89) **National comparison of absorbed doses of X radiation produced by therapeutical accelerators.** Wagner, R. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni); Novotny, J. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. ACCELERATORS/radiation doses; RADIATION DOSES/x radiation; ACCELERATORS; MEV RANGE 10-100; PHOSPHATE GLASS; RADIOTHERAPY; THERMOLUMINESCENT DOSEMETERS; X-RAY DOSIMETRY

5761 (INIS-mf–11562, pp. 17) **Comparison of methods of processing instrument spectra of high-purity Ge detector for dose estimation.** Fueloep, M. (Vyskumny Ustav Preventivneho Lekarstva, Bratislava (Czechoslovakia)); Krnac, S.; Hrabina, J.; Markovic, P. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. HIGH-PURITY GE DETECTORS/data processing; DOSIMETRY; RADIATION DOSES; SPECTRA

5762 (INIS-mf–11562, pp. 69) **Neutron spectrometry using sets of solid state track detectors.** Spurny, F. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni); Havlenova, J. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. DIELECTRIC TRACK DETECTORS/neutron spectroscopy; DATA PROCESSING; NEUTRON SPECTRA

5763 (INIS-mf–11562, pp. 19) **Possible application of EISPP experimental facility in handling radon.** Havlik, F. (Vyskumny Ustav Preventivneho Lekarstva, Bratislava (Czechoslovakia)); Urslova, M. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. LABORATORY EQUIPMENT/radon; DAUGHTER PRODUCTS; FILTERS; RADON; SPECIFICATIONS; VENTILATION

5764 (INIS-mf–11562, pp. 29) **NA 2601 beta radiation automatic analyzer.** Jursova, L. (Tesla, Premysleni (Czechoslovakia).

Vyzkumny Ustav Pristroju Jaderne Techniky); Broj, K.; Soukup, T.; Javornicky, K.; Martinek, J.; Bendl, J.; Vasek, T. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. SAMPLE CHANGERS/beta detection; LABELLED COMPOUNDS; LABORATORY EQUIPMENT

5765 (INIS-mf–11562, pp. 53) **Comparison of ionization and spectrometric measurements during aerial monitoring following the Chernobyl nuclear power plant accident.** Pernicka, F. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni); Filgas, R.; Kluson, J. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. IONIZATION CHAMBERS/aerial monitoring; NAI DETECTORS/aerial monitoring; CHERNOBYLSK-4 REACTOR; GAMMA SPECTROSCOPY; HEIGHT; RADIATION ACCIDENTS; RADIATION DOSES; REACTOR ACCIDENTS

5766 (INIS-mf–11562, pp. 59) **Application of new Czechoslovak dosimetric SI diode.** Prouza, Z. (Karlova Univ., Prague (Czechoslovakia). Fakulta Vseobecneho Lekarstvi); Obraz, O.; Kita, J.; Latal, F.; Sopko, B.; Spurny, F. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. GAMMA DOSIMETRY/silicon diodes; NEUTRON DOSIMETRY/silicon diodes; KERMA; PERFORMANCE; SENSITIVITY; SPATIAL DOSE DISTRIBUTIONS

5767 (INIS-mf–11562, pp. 60) **Experience with measuring surface contamination with ^{3}H and ^{14}C using LB 1210 B/LB 6255 device.** Rexa, R. (Univerzita P.J. Safarika, Kosice (Czechoslovakia). Katedra Vseobecnej Biologie); Filakovska, M.; Nyekiova, M. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. SURFACE CONTAMINATION MONITORS/proportional counters; CARBON 14; FLOW COUNTERS; SURFACE CONTAMINATION; TRITIUM

5768 (INIS-mf–11562, pp. 87) **Review of possible applications of scintillation detectors in measuring gamma dose rates.** Viererbl, L. (Tesla, Premysleni (Czechoslovakia). Vyzkumny Ustav Pristroju Jaderne Techniky); Novakova, O.; Jursova, L. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. GAMMA RADIATION/dose rates; SCINTILLATION COUNTERS/dose rates; GAMMA DOSIMETRY; RADIATION DOSES

5769 (JINR-R–1-88-504) **Spectrometric circuit for MIS-2 installation silicon target.** Cantoni, P. (Bari Univ. (Italy). Ist. Nazionale di Fisica Nucleare); Frabetti, P.L.; Kozarenko, E.N.; Mal'tsev, Eh.I.; Manfredi, P.F.; Petukhov, Yu.P.; Sychkov, S.Ya. Joint Inst. for Nuclear Research, Dubna (USSR). 1988. 6p. (In Russian). Order Number DE90610966. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Spectrometric circuit for 10-layer silicon target of JINR MIS-2 installation on IHEP accelerator is described. The main elements, characteristics, test results are described. It is noted that using of a j-FET with a high transconductivity and a charge-sensitive ADC as a gated integrator allows to improve resolution and counting properties. 5 refs.; 4 figs.; 1 tab.

5770 (LA-UR–89-3538) **A programmable multichannel correlation module for analyzing neutron multiplicities.** Arnone, G.J. (Los Alamos National Lab., NM (USA)); Brunson, G.S. Los Alamos National Lab., NM (USA). [1989]. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-891087–7: IEEE nuclear science symposium and exhibits, San Francisco, CA (USA), 25-27 Oct 1989). Order Number DE90002417. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We have developed a CAMAC module for analyzing neutron multiplicities. Reduction in dead time over previous methods has been made possible by providing independent detector channels. We have achieved a considerable reduction in circuitry by utilizing RAM and PROM integrated circuits in a nonstandard fashion. Along with specially developed algorithms, the module has been able to successfully unfold overlapping multiplicity chains for count rates varying over three orders of magnitude. 3 refs., 3 figs.

5771 (MPI-PAE/Exp.El.–207) **Studies of single superconducting grains for a neutrino and dark matter detector.** Frank, M.; Freund, P.; Gebauer, J.; Pretzl, K.; Singsaas, A.; Stodolsky, L. Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik. Aug 1989. 35p. Available from Available from Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik.

We have conducted various tests of the properties of single superconducting grains, of the type that have been suggested for use in detectors for dark matter and coherent neutrino scattering. These tests included study of the variation of the critical fields of the single grain when it is rotated relative to the applied field, observations concerning the existence of the intermediate state, and the effects of irradiation by alpha and gamma particles. The materials studied were Sn, Al and Zn at ^{4}He and ^{3}He temperatures. The variation of the critical (superheating) field under rotation suggests that the uncertainty of the phase boundary observed in the past for colloids of such grains is in large measure already present in the different orientations of a single grain. The irradiation experiments indicate that for certain materials a simple 'global heating' picture of the grain flip process applies in that the grain shows a well defined, sharp flip threshold in an applied field, one which furthermore is in accord with the superconducting specific heat of the grain. (orig.).

5772 (MPI-PAE/Exp.El.–209) **The possibility to measure the time dependence of B_s^0 - anti B_s^0 oscillations using Fourier analysis.** Moser, H.G. Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik. Aug 1989. 25p. Available from Available from Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik.

The possibility to observe the time evolution of B^0_s - anti B^0_s oscillations at a e^+e^- collider running at the Z^0 resonance is discussed. Using a Fourier analysis the accessible frequency range is calculated as a function of the experimental resolution and the available statistics. It can be shown that these oscillations can be measured up to a range of $\Delta m/\Gamma$ of about 8 with present technology (silicon vertex detectors) and luminosities which can be reached in the near future. (orig.).

5773 (NPL-RS(EXT)–112) **NPL contribution to a EURADOS Working Committee 4 intercomparison of unfolding codes for Bonner sphere data.** Thomas, D.J. National Physical Lab., Teddington (UK). Dec 1988. 34p. Available from the British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ.

Working Committee 4 of EURADOS (the European Radiation Dosimetry Group) have organized an intercomparison of unfolding codes used for deriving neutron spectra from Bonner sphere data. In July 1987 data for the exercise were circulated to a number of potential participants. All participants received data for 12 spectra, but not all participants received the same 12 spectra. This report details the results obtained when the data sets labelled PH1701->6 and PHI100->600, which were the ones received at NPL, were unfolded with the computer program STAY'SL. (author).

5774 (ORNL/FTR–3466) **[Workshop on nuclear structure in the era of new spectroscopy]: Foreign trip report, October 2–October 28, 1989.** Garrett, J.D. Oak Ridge National Lab., TN (USA). 8 Nov 1989. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002920. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler lectured on "New Ways to Look at Old (and New) Data" and served as a study group chairman at the four-week-long Workshop on Nuclear Structure in the Era of New Spectroscopy, Part B: The Nucleus at High Spin, held at the Niels Bohr Institute, October 2–27, 1989. He also visited the Tandem Accelerator Laboratory of the Niels Bohr Institute and, during the workshop, discussed plans for new nuclear structure instrumentation with various European colleagues.

5775 (ORNL/FTR–3474) **[Collaborations on the design and construction of the proposed L∗ detector for the Superconducting Super Collider]: Foreign trip report, October 8–October 18, 1989.** Appleton, B.R. Oak Ridge National Lab., TN (USA). 13 Nov 1989. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90003479. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The ORNL group, and Professor William Bugg from the University of Tennessee, Knoxville (UTK), had very productive meetings with Professor Sam Ting and other members of the L3 collaboration. The L3 detector system, subsystems, and the associated support facilities were examined in some detail. Discussions were held with scientists involved in planning for the L∗ detector systems and members of the L3 staff interested in positions at ORNL/UTK. Visits were also made to the ORNL WA80 experiment. The trip was very successful. A collaborative arrangement was established for ORNL to become involved in the future design and construction of the L∗ detector. These include hosting the main meeting of the L∗ collaboration at ORNL to complete the Expression-of-Interest document. Several prospective candidates were interviewed and collaborative interactions were started on some detector subsystems for L∗.

5776 (ORNL/FTR–3480) **[Intermediate voltage electron microscope]: Foreign trip report, November 7–12, 1989.** Kenik, E.A. Oak Ridge National Lab., TN (USA). 27 Nov 1989. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90003590. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This workshop, "Invitation to Hitachi Electron Microscopy Technology" was sponsored by Hitachi, Ltd. and was extended to nine electron microscopists from the USA and Europe. The main purpose of the trip was to introduce the first commercially available intermediate voltage electron microscope equipped with a field emission electron source. The capabilities of the Hitachi HF-2000 were demonstrated to this select group of microscopists. The HF-2000 appears to be the culmination of a long period of development by Hitachi to provide an electron microscope with good high spatial resolution imaging and analytical capabilities. In addition, some of the pioneering work on electron holography performed by Dr. A. Tonomura's group was highlighted. Brief reviews and demonstrations of analytical instruments and research at both the Hitachi Central Research Laboratory (HCRL) and the Naka Works were also given. There were many discussions of high resolution imaging, analytical electron microscopy, electron holography, and singular or combined applications of such techniques, and the particular electron microscopy needs, both current and future, of the visiting electron microscopists.

5777 (ORNL/FTR–3481) **[Workshop on nuclear physics with large arrays]: Foreign trip report, October 30–November 13, 1989.** Beene, J.R. Oak Ridge National Lab., TN (USA). 17 Nov 1989. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90003477. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler attended the third and final part of the three-month-long Workshop on Nuclear Structure in the Era of New Spectroscopy, held from September through November at the Niels Bohr Institute in Copenhagen, Denmark. The third or C part of this ambitious series of workshops was titled "Nuclear Physics with Large Arrays." The author presented four talks over a two-week period, at the invitation of the organizers.

5778 (OUP–89-14) **CACTUS - a multidetector set-up at the Oslo Cyclotron.** Guttormsen, M. (Oslo Univ. (Norway). Fysisk Inst.); Bjerke, B.; Messelt, S.; Olsen, E.A.; Ramsoey, T.; Rekstad, J.; Tveter, T.S.; Wikne, J.C.; Kownacki, J. Oslo Univ. (Norway). Fysisk Inst. Jun 1989. 13p. Order Number DE90610967. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The design and construction of the multidetector system CACTUS is discussed, and its operation in the context of the Oslo Cyclotron is described. The multidetector system has been initiated to meet the requirements at the Oslo Cyclotron Laboratory in the experimental work on nuclear structure at high intrinsic excitation energy. The laboratory has developed a promising technique based on measuring γ-decay after single nucleon transfer reactions with the use of $p\gamma$ coincidences. However, a proper interpretation of the experimental results has often been difficult due to low counting rates. One of the most important aims for the new experimental set-up has been to obtain $p\gamma$ as well as $p\gamma\gamma$ coincidence spectra with high statistics. The CACTUS detector system which is mounted on the 90° beam line of the cyclotron, consists of 28 NaI and 2 Ge detectors in combination with 8 Si particle telescopes.

5779 (PB–89-235667/XAB) **Apparatus for neutron-scattering measurements on sheared fluids.** Straty, G.C. Great Lakes Fishery Commission, Ann Arbor, MI (USA). 1989. 3p. Available from NTIS, PC A04.

Included in Jnl. of Research of the National Institute of Standards and Technology, Vol. 94, No. 4, 259-261(Jul/Aug 1989).

The construction of an apparatus to allow neutron-scattering measurements on fluids undergoing shear is reported. The apparatus has been used with the cold-neutron small-angle-neutron-scattering (SANS) spectrometer at the NIST research reactor and will be made available to users as a permanent part of the NIST facility.

5780 (SCIPP–88/40) **Tracking requirements for the SSC and silicon strip development.** DeWitt, J.; Dorfan, D.; Litke, A.; Sadrozinski, H.; Seiden, A.; Weinstein, A. California Univ., Santa Cruz, CA (USA). Inst. for Particle Physics. Nov 1988. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-80ER10667. (CONF-8806243–46: DPF summer study: Snowmass '88: high energy physics in the 1990s, Snowmass, CO (USA), 27 Jun - 15 jul 1988). Order Number DE90003724. Available from NTIS, PC A02/MF A01; OSTI; INIS.

We quantify the design parameters for a central tracking system capable of good momentum measurements and high reconstruction efficiency for charged particles within 1 TeV jets. We express our results as a set of scaling rules. Based on these rules we outline a silicon strip tracking system which is well matched to the SSC high luminosity environment. Special challenges for the construction of this tracker are in the area of electronics readout. We present initial work we have done in this area. 11 refs., 16 figs., 1 tab.

5781 (SLAC-PUB–5072) **The fast simulation of electromagnetic and hadronic showers.** Grindhammer, G. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)); Rudowicz, M.; Peters, S. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Oct 1989. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-890379–17: Workshop on calorimetry for the SSC, Tuscaloosa, AL (USA), 13-17 Mar 1989). Order Number DE90004426. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A program for the fast simulation of electromagnetic and hadronic showers using parameterizations for the longitudinal and lateral profile is described. The fluctuations and correlations of the parameters are taken into account in a consistent way. Comparisons with data over a wide energy range are made. 15 refs., 17 figs.

5782 (SLAC-PUB–5105) **Monitor and control systems for the SLD Cherenkov Ring Imaging Detector.** Antilogus, P. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)); Aston, D.; Bienz, T.; Bird, F.; Dasu, S.; Dunwoodie, W.; Fernandez, F.; Hallewell, G.; Kawahara, H.; Korff, P.; Kwon, Y.; Leith, D.; Muller, D.; Nagamine, T.; Pavel, T.; Rabinowitz,Stanford Linear Accelerator Center, Menlo Park, CA (USA); California Univ., Santa Barbara, CA (USA). Dept. of Physics. Oct 1989. 9p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract AC03-76SF00515;AT03-76ER70023. PHY85-12145;PHY85-13808. (CONF-891094–6: International conference on accelerator and large experimental physics control systems, Vancouver (Canada), 30 Oct - 3 nov 1989). Order Number DE90004429. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

To help ensure the stable long-term operation of a Cherenkov Ring Detector at high efficiency, a comprehensive monitor and control system is being developed. This system will continuously monitor and maintain the correct operating temperatures, and will provide an on-line monitor and maintain the correct operating temperatures, and will provide an on-line monitor of the pressures, flows, mixing, and purity of the various fluids. In addition the velocities and trajectories of Cherenkov photoelectrons drifting within the imaging chambers will be measured using a pulsed uv lamp and a fiberoptic light injection system. 9 refs., 6 figs.

5783 (SLAC-PUB–5122) **The Active Personnel Dosimeter: Apfel Enterprises superheated drop detector.** Ipe, N.E.; Donahue, R.J.; Busick, D.D. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Oct 1989. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (CONF-891104–1: 9. international conference on solid state dosimetry, Vienna (Austria), 6-10 Nov 1989). Order Number DE90004430. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The Active Personnel Dosimeter (APD) provides a digital readout of events caused by neutrons interacting with superheated liquid droplets. The droplets are suspended in a gel held in a replaceable cartridge. Upon neutron interaction, the superheated droplet vaporizes, forming a bubble. The sound produced in this process is recorded by transducers that sense the accompanying pressure pulse. The APD electronically discriminates against spurious noise and vibration. Studies with the production prototype APDs indicate that the detector response is linear up to about 0.40 mSv, with large variations sometimes from predicted values and between cartridges at higher dose equivalents. The response to standard neutron sources (bare ^{252}Cf, PuBe, PuB, PuF, PuLi) is reported and compared with the expected response. Unirradiated cartridges self-nucleate when heated to temperatures of 46°C. The APD is insensitive to low-energy photons but responds to high-energy photons and electrons. 9 refs., 2 figs., 3 tabs.

5784 (UCRL–101630) **Integration of a gated microchannel plate detector into the Nova laser system.** Wiedwald, J.D.; Hanks, R.L.; Tietbohl, G.L.; Bishop, D.O.; Power, G.D.; Kelly, F.R.; Bell, P.M. Lawrence Livermore National Lab., CA (USA). 11 Aug 1989. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890836–19: 33. SPIE annual international technical symposium on optical and optoelectronic applied science and engineering, San Diego, CA (USA), 6-11 Aug 1989). Order Number DE90002981. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In recent years the measurements of Inertial Confinement Fusion (ICF) target dynamics using x-ray imaging have grown in both quality and quantity. One instrument being used increasingly at the Lawrence Livermore National Laboratory's Nova facility is the Gated X-Ray Imager. This imager uses a microchannel plate as detector, amplifier, and gating element to allow x-ray photographs with aperture times under 100 ps. In anticipation of as many as 16 imagers installed on Nova within the next year, an electronic control system has been developed. This system simplifies operator interface when in a "stand-alone" mode while synchronizing with the Nova sequence clock when in the "shot" mode. The system is also expected to be fully integrated into the Nova computer system within the next year. This will allow remote parameter input and the monitoring and archiving of system status. 9 refs., 5 figs., 1 tab.

5785 (UCRL–102155) **YB_{66}: A new soft x-ray monochromator for synchrotron radiation.** Wong, J. (Lawrence Livermore National Lab., CA (USA)); Shimkaveg, G.; Goldstein, W.; Eckart, M.; Tanaka, T.; Rek, Z.U.; Tompkins, H. Lawrence Livermore National Lab., CA (USA). Oct 1989. 21p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890802–17: 7. synchrotron radiation instrumentation (SRI) national conference, Berkeley, CA (USA), 6-10 Aug 1989). Order Number DE90003621. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

YB_{66}, a complex binary semiconducting compound, cubic in crystal structure with a cell parameter of 23.44 Å, has been singled out as a potentially useful soft x-ray monochromator for dispersing synchrotron radiation. There is no intrinsic absorption by the constituent elements in the region 1-2 keV (the Y L_3-edge is at 2080 eV). Using the known structure factors for the (400) and (222) reflections having 2d values of 11.76 Å and 13.53 Å respectively, their rocking curves have been calculated and are shown to be comparable to or better than that of beryl (1010). In terms of vacuum compatibility, resistance to radiation damage, thermal and mechanical stability, YB_{66} satisfies all the material requirements for use as a monochromator for synchrotron radiation in the soft x-ray region. Recent experiments in growing single crystals of this material large enough to intercept 1 mrad of radiation are discussed. Rocking curve measurements, etch pit density, and x-ray white beam topography are used to characterize the quality of these large crystals as a function of some critical growth parameters such as pulling rate and thermal gradient at the crystal-liquid interface. From this study, it is clear that future work should be directed toward the control and retention of convexity of the crystal-liquid interface during growth, a key factor to achieve high perfection crystals. 12 refs., 9 figs., 1 tab.

5786 (WSRC-RP–1017) **Measuring total activity of groundwater samples using liquid scintillation.** Killeen, T.P. (Westinghouse Savannah River Co., Aiken, SC (USA)); Morrison, A.S.; Stevenson, D.A.; Rucker, T.L. Westinghouse Savannah River Co., Aiken, SC (USA). 1989. 16p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. (CONF-8911134–1: 35. annual conference on bioassay, analytical and environmental radiochemistry, Charleston, SC (USA), 2 Nov 1989). Order Number DE90003504. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The US Department of Transportation (DOT) requires all radioactive materials ($\geq$2 nCi/g) that are shipped on public transportation routes to be labeled as radioactive and to clearly label the level of radioactivity. The Environmental Monitoring Section (EMS) of the Westinghouse Savannah River Company (WSRC) ships many potentially radioactive samples to contract laboratories for specific chemical analyses to be performed. These samples must be analyzed for radioactivity before shipment to ensure compliance with DOT regulations, and to alert the laboratory to properly handle radioactive samples. The original radioactive screening policy was to routinely perform three analyses (tritium, gross alpha and non-volatile beta) before shipping samples off site. However, the sensitivity of these analyses exceeded the sensitivity needed to fulfill DOT labeling requirements. Additionally the three analyses created storage problems, excessive laboratory analyses and shipment delays which have invalidated some analytical results when EPA holding times have been exceeded. An analysis for total activity using a liquid scintillation system has replaced the tritium, gross

alpha and nonvolatile beta analyses, and it compares favorably with the previous procedures. The results from total activity analyses using liquid scintillation consistently fall within the uncertainty measurements for tritium results: tritium typically comprises >99% of a sample's activity.

5787 **Ultrafast photoconductive detector-laser-diode transmitter.** Wang, C.L. (Lawrence Livermore National Lab., PO Box 808, Livermore, CA (US)); Davies, T.J.; Nelson, M.A.; Thomas, M.C.; Zagarino, P.A.; Davis, B.A. pp. 380 of Optoelectronic materials, devices, packaging, and interconnects. Batchman, T.E.; Carson, R.F.; Gallawa, R.L.; Wojtunik, H.J SPIE Society of Photo-Optical Instrumentation Engineers, Bellingham, WA (1987). DOE Contract W-7405-ENG-48. (CONF-8708229–: Optoelectronic materials, devices, packaging, and interconnects, San Diego, CA (USA), 19-21 Aug 1987).

The authors report the results of an experiment in which they used an ultrafast, photoconductive, radiation detector to drive a fast laser-diode transmitter. When they irradiated the neutron-damaged Cr-doped Ga/As detector with 17-MeV electron beams, the temporal response of was measured to be less than 30 ps. The pulses from this detector modulated a fast GaAlAs laser diode to transmit the laser output through 30- and 1100-m optical fibers. Preliminary results indicate that 50- and 80-ps time resolutions, respectively, are obtainable with these fibers. They are now working to integrate the photoconductive detector and the laser diode transmitter into a single chip.

4402 Radiation Effects on Instrument Components, Instruments, or Electronic Systems

Refer also to citation(s) 5533, 5534

5788 (AD-A–211763/8/XAB) **Energetic electron-induced impurity ionization in Si:As IBC detectors.** Boisvert, J.C.; Flesner, L.D. Naval Ocean Systems Center, San Diego, CA (USA). Dec 1988. 8p. Available from NTIS, PC A02/MF A01.

Pub. in IEEE Transactions on Nuclear Science, Vol. 36, No. 6, 1307-1312(Dec 1988).

The problem of persistent dose-rate gamma noise in impurity-band conduction (IBC) silicon infrared detectors was investigated using a novel experimental approach. Of interest is the possibility that energetic electrons from gamma events create impurity-band carriers as well as intrinsic carriers. If collected, these carriers would compare a significant component of the gamma pulse amplitudes. To test this, an experiment was conducted to determine the ratio of impurity-band holes to valence-band holes collected in response to incident energetic electrons, such as those resulting from a gamma event. An upper limit of 10% was found for this ratio. The transient response was measured for pulses of both 20-micrometer IR and energetic electron (13 keV and 39 keV) irradiation; and the much-longer transit time of impurity-band holes relative to that of valence-band holes and electrons was used to distinguish their contribution to the current. A first-order model for the transient response was derived that predicted contributions from RC time-constant (dielectric relaxation time) effects in the undepleted regions of the detector as well as from transit-time (drift) effects in the depleted regions, and allowed the deconvolution of the two contributions.

4406 Optical Instrumentation

Refer also to citation(s) 5513, 5629

5789 (BNL–43421) **A low pressure, parallel plate avalanche chamber for detection of soft x-ray fluorescence.** Smith, G.C. (Brookhaven National Lab., Upton, NY (USA)); Krol, A.; Kao, Y.H. Brookhaven National Lab., Upton, NY (USA); State Univ. of New York, Buffalo, NY (USA). Dept. of Physics. Sep 1989. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016;FG02-87ER45283. AFSOR-88-0095. (CONF-890802–18: 7. synchrotron radiation instrumentation (SRI) national conference, Berkeley, CA (USA), 6-10 Aug 1989). Order Number DE90003626. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A description is given of the design considerations and performance of a low pressure, parallel plate avalanche chamber (PPAC), for use in detecting soft x-ray fluorescence. Detection efficiency and energy resolution are discussed and the application of the PPAC to detection of fluorescence emission from a high T_c superconductor is outlined. 8 refs., 7 figs.

5790 (ENEA-RT-TIB–88-48) **Coherent anti-stokes Raman scattering instrument for chemical and photochemical processes.** Fantoni, R.; Schina, G.; Engeln, R. ENEA, Frascati (Italy). Centro Ricerche Energia. May 1989. 26p. Order Number DE90724606. Available from NTIS (US Sales Only), PC A03/MF A01.

A nonintrusive diagnostic system is described which permits simultaneous measurement of number density and temperature of small molecules in hostile environments such as chemical or photochemical reactors. This system is formed by a frequency-doubled Nd:YAG laser which is partially used to excite a broadband dye laser. The system utilizes a collinear beam arrangement, the signals are detected with an intensified photodiode array after proper filtering and wavelength separation through a 60 degrees prism and a monochromator. Calibration measurements were performed on small molecules (silane, ammonia, acetylene, ethylene, C_2H_6) involved in the infrared radiation (IR) laser induced photosynthesis of ceramic powders (silicon nitride and silicon carbide). The effect of non-resonant background in number density measurements due to carrier gasses used in flow reactors was carefully investigated in cell experiments. The strong temperature dependence of the envelope of the vibrorotational Raman active band, detected at rather low resolution, is demonstrated in band contour calculations performed on hydrocarbons (C_2H_6 and acetylene).

5791 (EPRI-ER–6537) **Fiber-optic sensing workshop: Proceedings.** Lee, R.A.S. (Foster-Miller, Inc., Waltham, MA (USA)); Levin, P. Electric Power Research Inst., Palo Alto, CA (USA); Foster-Miller, Inc., Waltham, MA (USA). c Oct 1989. 65p. Sponsored by Electric Power Research Institute. (CONF-8810442–: Fiber-optic sensing workshop, Charlotte, NC (USA), 6 Oct 1988). Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

The objective of this workshop was to assess the potential applications of fiber optic sensors in utility system applications. Particular attention was given to the limitations of current fiber optic sensors so as to define the range over which they can be applied. Limitations such as temperature, radiation, and survivability in water and steam highlighted some areas that could benefit by further research. Testing in a utility environment would develop a firmer basis of judging the operating characteristics and limitations of current systems. The applications discussed included power plant temperature, pressure, differential pressure, liquid level leak detection, and chemical measurements. Discussions on stress and strain sensors included power plant and transmission system applications. Electrical system applications included voltage, current, voltage gradients, and transmission line sag. 28 figs.

5792 (UCRL–101579) **Picosecond photoconductivity using a graded bandgap $Al_xGa_{1-x}As$ active detecting layer.** Morse, J.D. (Lawrence Livermore National Lab., CA (USA)); Mariella, R.P.; Dutton, R.W. Lawrence Livermore National Lab., CA (USA). Nov 1989. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-891205–2: IEEE international electron devices meeting, Washington, DC (USA), 3-6 Dec 1989). Order Number DE90003452. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper presents a concept where improved responsivity for picosecond photoconductors is achieved by utilizing a graded bandgap $Al_xGa_{1-x}As$ active detecting layer grown on a high defect density. Low temperature GaAs layer by MBE. By taking advantage of the superior transport properties of the graded $Al_xGa_{1-x}As$ layer, order of magnitude improvement in responsivity has been demonstrated, along with 2 to 6 times improvement in peak photo-current response. 8 refs., 6 figs.

5793 **Use of a charge-coupled device camera for broadband coherent anti-Stokes Raman scattering measurements.** Rakestraw, D.J. (Sandia National Labs., Livermore, CA (USA).

Combustion Research Facility); Lucht, R.P. pp. 443 of OSA conference on lasers and electro-optics (1989 Technical Digest series). Optical Society of America, Washington, DC (1989). (CONF-890423–: CLEO '89: conference on lasers and electro optics, Baltimore, MD (USA), 24-28 Apr 1989).

Technical Paper TUJ48.

The authors recently used an unintensified charge coupled device (CCD) camera for measurement of boardband coherent anti-Stokes Raman scattering (CARS) signals. The use of an unintensified CCD camera rather than in intensified linear photodiode array (IPDA) for signal detection offers considerable advantages for CARS applications, including higher resolution and improved instrument function, larger dynamic range, and a 2-D format. These unintensified CCD cameras which have traditionally been used for astronomical imaging have not, to their knowledge, been used for detection of broadband CARS signals. They performed broadband CARS measurements of nitrogen spectra to obtain temperatures in engines using an IPDA as the detector. To investigate the use of CCD cameras for CARS measurements, the linear IPDA was replaced with a Photometrics CCD camera system.

4408 Miscellaneous Instrumentation

Refer also to citation(s) 4787, 5462, 5668, 5698, 5834, 5905, 6112, 6475

5794 (DOE/ER/13347–3) **Hadamard transform spectrometry: A new analytical technique: Progress report.** Hall, W. Kansas State Univ., Manhattan, KS (USA). Dept. of Chemistry. 10 Nov 1989. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER13347. Order Number DE90003545. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The following four projects were expanded during the second year of this three year program. (a) Construction of a stationary interferometer for possible use in the Hadamard transform Raman high performance liquid chromatography (HPLC) experiment. (b) Construction of a dispersive Hadamard transform spectrometer with concave holographic gratings for possible application as a HPLC detector. (c) Investigation of both colloidal-dispersed and polymer-dispersed liquid crystal materials as efficient optical shutters for making improved Hadamard encoding masks. (d) Improvement of the software necessary to recover a spectrum from the Hadamard encoded data. 1 fig.

5795 (DOE-tr–89-42) **Specifications for invention for inventor's certificate: Pneumatic contactless servo measuring device.** (Opisaniye izobreteniya k avtorskomu svideltel'stvu: Pnevmaticheskoye veskontaktnoye izmeritel'noye ustroystvo sledyashchego tipa). Zinov'yev, Y.G.; Kondashevskiy, V.V.; Leuk, V.S.; Tret'yakov, A.V. USDOE, Washington, DC (USA). 1989. 3p. Translation of Russian Patent No. 286242, 1970. Sponsored by U.S. DOE Management & Administration. Order Number DE90002752. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This invention relates to the field of measurement technology, and specifically to pneumatic measurement of linear dimensions. A pneumatic contactless servo measuring device is known, containing a nozzle tip positioned above the surface being tested, a movable arm bearing the tip, a unit to read the movements of the arm and a unit to deliver compressed air to the tip. The proposed device differs from the known device in that its tip is executed in the form of a disk with a convex ring directed toward the surface being tested and connected to the arm by a spherical hinge. 1 fig.

5796 (INIS-mf–11562, pp. 55) **Testing film holder for determining high voltage at X-ray tube.** Petrova, K. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni); Kodl, O.; Zachariasova, I. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. X-RAY TUBES/performance testing; ELECTRIC POTENTIAL; LABORATORY EQUIPMENT; PHOTOGRAPHIC FILMS

5797 (IYaF–88-98) **ATsP-101SK and ATsP-850SK S-series pulsed signal shape registers.** Batrakov, A.M.; Kozak, V.R.; Kruglyakov, M.Eh. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 22p. (In Russian). Order Number DE90610312. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A new series of standartized CAMAC pulse shape recorders has been developed (series S). Two 4-channels modules of this series are discribed: ATsP-101SK and ATsP-850SK. ATsP-101SK one provides maximum sampling rate of 1 mus/pulse and 10 bit resolution. ATsP-850SK module provides 50 ns/pulse and 8 bit resolution. The structure and design conseptions of the main units are analysed. The user manual is given. 3 refs.; 10 figs.

5798 (LBL–27660) **X-ray microimaging for the life sciences.** Attwood, D.; Barton, B. (eds.). Lawrence Berkeley Lab., CA (USA). Aug 1989. 206p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC03-76SF00098. (CONF-8905192–: Conference on X-ray microimaging for the life sciences, Berkeley, CA (USA), 24-26 May 1989). Order Number DE90002613. Available from NTIS, PC A10/MF A01 - OSTI; GPO Dep.

The workshop brought together the physical and biological science communities to explore the potential for imaging of macromolecular to sub-organelle structures, in their natural state, with spacial resolutions beyond those hitherto demonstrated. Emphasis was on direct imaging techniques applied to biological problems of structure and function, sequencing, and mapping. The requisite high brightness radiation sources, such as short wavelength undulators and x-ray lasers, were also addressed. In addition there were overviews of current and projected capabilities utilizing tunneling techniques, electron microscopy, and x-ray crystallographic techniques. Individual papers will be processed separately for the data base.

5799 (SAND–89-1472C) **Effective utilization of acoustic wave sensor responses: Simultaneous measurement of velocity and attenuation.** Martin, S.J.; Ricco, A.J. Sandia National Labs., Albuquerque, NM (USA). [1989]. 21p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8910216–2: Ultrasonics symposium, Montreal (Canada), 3 Oct 1989). Order Number DE90002580. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

When acoustic wave devices are used as sensors, responses arise from perturbations in wave propagation characteristics (velocity and attenuation) caused by wave interactions with a surface layer. Simultaneous measurement of both velocity and attenuation changes helps elucidate the wave perturbation mechanisms. A number of wave-surface layer interactions have been investigated involving surface acoustic waves (SAWs) in the gas phase and acoustic plate modes (APMs) in liquids. These include (1) mass loading of a SAW, (2) acoustoelectric interactions between SAWs and a conductive film overlay, (3) mass loading of an APM, and (4) viscous coupling of an APM to an adjacent liquid medium. 13 refs., 6 figs.

5800 (UCRL–101939) **The future of NEC-like models.** Burke, G.J. Lawrence Livermore National Lab., CA (USA). [1989]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8910303–1: IEEE colloquium of large scale programs for use in antenna performance predictions, London (UK), 30 Oct 1989). Order Number DE90003052. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The method of moments (MoM) was the basis of the earliest large scale, general purpose EM modeling codes, and the Numerical Electromagnetics Code (NEC) traces its ancestry to one of the first of these large codes, AMP. A number of EM codes is now in use, some much larger than NEC, based on MoM, GTD, the finite-difference solution of Maxwell's curl equations or a combination of techniques. Substantial progress has been made in modeling techniques, and further large gains have been derived from the growth

in available computing power. Still, one does not need to get too involved in computational electromagnetics to find that the available modeling tools often fall short of the user's needs. Some of the gaps in the modeling capabilities available to the typical code user might be met now by making more of the developments of recent years available in documented and supported codes. For other problems, advances in techniques are needed, such as pushing MoM to larger problems, possibly involving thousands of unknowns, and developing hybrid models so that optimum methods can be used on each part of a complex structure. NEC has been under continuing development, and a new release of the code is planned that will correct some problems in the present version in areas of wire modeling and code structure. Still, it remains basically a wire modeling code with some capabilities for surfaces. The present features of NEC and improvements planned for the next release are summarized below, followed by a discussion of some possibilities for extending the capabilities of NEC or similar codes. 9 refs.

45 MILITARY TECHNOLOGY, WEAPONRY, AND NATIONAL DEFENSE

Refer also to citation(s) 5175, 5697, 6452

5801 (CONF-891257–1) **PDE models for combat: Potential applications to LIC (Low Intensity Combat).** Protopopescu, V.; Santoro, R.T.; Azmy, Y.Y. Oak Ridge National Lab., TN (USA). [1989]. 18p. Sponsored by U.S. Department of Defense; U.S. DOE Defense Programs. DOE Contract AC05-84OR21400. 1868-A037-A1. From Special operations and low-intensity conflict symposium: defending US interests; Alexandria, VA (USA); 4-5 Dec 1989. Order Number DE90003713. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Acute or subdued conflict situations (ranging from fierce combat to peaceful competition) are modeled by using nonlinear partial differential equations that account for both temporal and spatial evolution of the system. One- and two-dimensional applications to conventional warfare are reported. The discretized version of the model resulting in a nonlinear map is used to investigate the chaotic aspects of a conflict situation. The comparison between our model and a wargame exercise yields excellent agreement and provides a strong validation basis for further developments. 19 refs., 6 figs.

5802 (SAND–89-1913C) **SO/LIC [Special Operations/Low-Intensity Conflict] projects and programs.** Williams, J.D. Sandia National Labs., Albuquerque, NM (USA). [1989]. 14p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-891257–1: Special operations and low-intensity conflict symposium: defending US interests, Alexandria, VA (USA), 4-5 Dec 1989). Order Number DE90003514. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper describes a number of Special Operations (SO) and Low Intensity Conflict (LIC) projects and programs which have been completed or are now ongoing at Sandia National Laboratories. Some of the items discussed include field security surveys (conducted to immediately improve the security of deployed forces and to gain information about what additional resources are needed), a portable physical security system known as SAFER (Security and Force-Protection Enhancement Resources), interchangeable weapon scope mounts, a non-electric (NONEL) initiator, a diversionary charge, and a return fire simulator. 4 figs.

4501 Chemical Explosions and Explosives

Refer also to citation(s) 5352, 5459, 5693, 6048

5803 (AD-A–211364/5/XAB) **Large blast and thermal simulator advanced concept driver design by computational fluid dynamics. Final report, 1987-1989.** Opalka, K.O. Army Armament Research and Development Command, Aberdeen Proving Ground, MD (USA). Ballistics Research Lab. Aug 1989. 68p. (BRL-TR–3026). Available from NTIS, PC A04/MF A01.

The construction of a large test facility has been proposed for simulating the blast and thermal environment resulting from nuclear explosions. This facility would be used to test the survivability and vulnerability of military equipment such as trucks, tanks, and helicopters in a simulated thermal and blast environment, and to perform research into nuclear blast phenomenology. The proposed advanced design concepts, heating of driver gas and fast-acting throat valves for wave shaping, are described and the results of CFD studies to advance these new technical concepts fro simulating decaying blast waves are reported.

5804 (LA-UR–89-2467) **Thermal initiation caused by fragment impact on cased explosives.** Schnurr, N.M. (Los Alamos National Lab., NM (USA)). Los Alamos National Lab., NM (USA). [1989]. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. (CONF-891208–13: Winter annual meeting of the American Society of Mechanical Engineers, San Francisco, CA (USA), 10-15 Dec 1989). Order Number DE89015303. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Numerical calculations have been used to predict the velocity threshold for thermal initiation of a cased explosive caused by fragment impact. A structural analysis code was used to determine temperature profiles and a thermal analysis code was used to calculate reaction rates. Results generated for the United States Air Force MK 82 bomb indicate that the velocity threshold for thermal initiation is slightly higher than that for the shock-to-detonation process. 8 refs., 5 figs., 2 tabs.

5805 (UCID–21763) **A future for LLNL [Lawrence Livermore National Laboratory] research in composite high explosives.** Hickman, R.G. Lawrence Livermore National Lab., CA (USA). Oct 1989. 43p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90004442. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The purpose of this study was to provide direction for research in composite high explosives at LLNL. This category of explosives has been known for hundreds of years and it potentially can provide performance higher than HMX and still be insensitive. The reasons to seek such a material are set forth in the context of programmatic benefit. Explosive performance is reviewed along with some fundamental limits and possibilities for the future. It is concluded that the research should continue for the purpose of enhanced safety and that a reasonable goal is to produce an explosive with 20% greater performance than TATB. 96 refs.

4502 Nuclear Explosions and Explosives

5806 (PB–89-871677/XAB) **Terrorism. January 1970-September 1989 (Citations from the NTIS data base). Report for January 1970-September 1989.** National Technical Information Service, Springfield, VA (USA). Sep 1989. 134p. Available from NTISPC N01/MF N01.

Supersedes PB–88-868286.

This bibliography contains citations concerning political, psychological, and sociological studies of international and domestic terrorism, including activities in the Middle East, Europe, and North and South America. Terrorism and countermeasures with respect to diplomacy, intelligence, law enforcement, military operations, and security systems are considered. Nuclear materials management regarding terrorist activities is also included. (This updated bibliography contains 276 citations, 88 of which are new entries to the previous edition.)

5807 (SAND–89-1008) **Analysis of the enabled MC3831 dual stronglink.** Kotulski, J.D. Sandia National Labs., Albuquerque, NM (USA). Mar 1989. 38p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE90003069. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The electrical parameters that describe the MC3831 dual stronglink as a function of the air-gap lengths of the system are examined. The electrical parameters include the self-inductances of the primary (30-turn) and secondary (1100-turn) windings and the coupling factor. A magnetic-circuit analysis determines the electrical parameters for varying air-gap lengths. Results of this analysis are found to be consistent with experimental data. 5 refs., 10 figs., 3 tabs.

5808 (SSS-R–79-3973) **Late time containment research: Final report, January–December 1978.** Duff, R.E.; Peterson, E.W.; Barthel, J.R. Systems, Science and Software, La Jolla, CA (USA). Feb 1979. 94p. Sponsored by U.S. Department of Defense. DNA001-77-C-0099. Order Number DE90003444. Available from NTIS, PC A05/MF A01 - OSTI.

This report summarizes numerous activities undertaken in a continuing program of support for the Defense Nuclear Agency underground nuclear testing program. Emphasis is given to the analysis of the past events Red Hot and Hybla Gold and to the proposed Huron King. Continuing analyses of the grout spheres and the symmetrical plasma generator simulation efforts are reported. Two investigations of asymmetric line-of-sight configurations are summarized. 29 refs., 31 figs.

5809 (UCID–21826) **Predicted deflections of the BARNWELL nuclear test canister.** Trummer, D.J.; McCallen, D.B. Lawrence Livermore National Lab., CA (USA). Oct 1989. 22p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90004445. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The magnitude of the deflections of stemmed nuclear test canisters has become a major issue in the fielding of an event. With tight alignment tolerances becoming more commonplace, it is a concern that experimental physics data could be lost or significantly degraded in quality if deflections approach those measured in a number of past events. The BARNWELL canister is similar to the CONTACT canister in that it will have various stiffening schemes incorporated into its design to help reduce deflections. BARNWELL, however, will in all likelihood only be partially enclosed with doors (CONTACT was fully enclosed with doors). To assess the effect of these stiffening schemes and door configuration on the overall canister stiffness, computer models of the BARNWELL canister were constructed for numerical simulations. This report contains the results of the numerical simulations and comparisons between the predicted CONTACT and BARNWELL deflections. 8 refs., 11 figs., 1 tab.

5810 (UCRL–100837) **Physical properties in LLNL Yucca Flat areas: The ROCK PILE Concept.** Burkhard, N.R. Lawrence Livermore National Lab., CA (USA). Sep 1989. 53p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8909163–9: 5. symposium on containment of underground nuclear detonations, Santa Barbara, CA (USA), 19-21 Sep 1989). Order Number DE90003596. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

Measurements of grain density, bulk density, water content and seismic travel time have been made for over two decades in Yucca Flat. The basic data set consists of the zonal averages of the LLNL Yucca Flat stratigraphic units for bulk density, grain density, water content, porosity, gas-filled porosity, and saturation and of the average work point velocities and average overburden velocities. The errors associated with the zonal averages were calculated and used to determine whether future measurements are warranted. The velocity data were fitted with smooth functional forms to determine whether velocity is predictable from depth alone. Analysis of the measurements indicates that an adequate sampling of the units in Yucca Flat has been obtained for the average physical properties of the stratigraphic units. Further measurement of grain densities at specific depth horizons is not needed. Larger contributions to the calculated errors in porosity, gas-filled porosity, and saturation come from measurement errors in bulk density and water content. The error associated with assuming a bulk density and a water content for a stratigraphic unit is comparable to the measurement error for these properties. Therefore these properties and the properties calculated from them can usually be assumed with about the same accuracy as if measurements had been made. Consequently it appears that what is really needed is a measurement which would determine the presence of anomalous properties. The average overburden velocity and the average work point velocity are not as predictable as the physical properties of the stratigraphic units. 2 refs., 8 figs., 3 tab.

5811 (UCRL–100961) **The effect of cavity gas pressure and porous flow on stemming performance.** Hudson, B. (Lawrence Livermore National Lab., CA (USA)); Trent, B. Lawrence Livermore National Lab., CA (USA). Sep 1989. 20p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8909163–8: 5. symposium on containment of underground nuclear detonations, Santa Barbara, CA (USA), 19-21 Sep 1989). Order Number DE90003615. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

For several years the philosophy of containment science in general and stemming design in particular has been to stop high levels of gas pressure and the associated radiation "deep in the hole." The principal reason for this is that containment is not an exact science, so a factor of safety is achieved by trying to keep the radioactive products generated by the nuclear explosion as far underground as possible. The uncertainty stems from several factors, including the in-situ physical properties of the geologic materials, the specific mechanisms which cause formation of the residual stress field, the extent and nature of faulting, and the influence of water on overall containment. Other factors that are more certain are the location of geologic layers, the placement of the stemming materials and the physical properties of those materials. Lawrence Livermore National Laboratory has taken an aggressive stand with respect to making field measurements of pressure, radiation and ground motion in order to understand the process of gas flow in the stemming after an underground nuclear test. Calculational models at Los Alamos National Laboratory have been applied to this problem to determine the influence of bulk material properties on gas flow and the transport of radioactive contaminants. The purpose of this paper is to show how the field data may be used to calibrate the models in order to identify likely phenomena taking place underground. 4 refs., 15 figs., 2 tabs.

5812 (UCRL–101559) **An overview of projectile penetration into geological materials, with emphasis on rocks.** Heuze, F.E. (Lawrence Livermore National Lab., CA (USA)). Lawrence Livermore National Lab., CA (USA). Aug 1989. 39p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-891235–1: American Society of Mechanical Engineers symposium on computational techniques for impact, penetration and perforation of solids, San Francisco, CA (USA), 10-15 Dec 1989). Order Number DE89016513. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

An extensive study was performed of the experimental and analytical aspects of projectile penetration in rocks and soils. The experimental data base is much larger for soils than it is for rocks, in which few instrumented penetration tests have been performed. To extrapolate experimental results, several methods of analysis and prediction have been proposed: empirical approaches, such as those of Sandia National Laboratories and the Army's Waterways Experiment Station, analytical methods, such as cavity expansion theories and the differential area force law, and numerical modeling by a variety of techniques, i.e., finite differences, finite elements, and discrete elements. This paper contains a comprehensive summary of the features of the various computer programs used for penetration modeling, in many materials and at various speeds, over the past 20 years. 144 refs., 9 figs., 3 tabs.

5813 (UCRL–101955) **Bound water corrections of epithermal-neutron-derived water contents.** Burkhard, N.R.; Hearst, J.R. Lawrence Livermore National Lab., CA (USA). Sep 1989. 17p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8909163–7: 5. symposium on containment of underground nuclear detonations, Santa Barbara, CA (USA), 19-21 Sep 1989). Order Number DE90003616. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Water contents from epithermal neutron logs are used with bulk density and grain density data to calculate the porosity, gas-filled porosity, and saturation of the geologic media surrounding emplacement holes. The epithermal neutron log measures the total hydrogen content of the formation; the water content is calculated from that. However, the derived water content includes both bound and free water. Four methods have been examined to separate the total water content into free and bound water. The methods are: (1) determination of bound water from chemical formulae; (2) corrections based upon epithermal neutron response to standard minerals; (3) thermogravimetric analyses (heating) of samples; (4) empirical corrections derived from the logging data. There are fundamental difficulties with each method. The problem centers around

deciding what is free water and what is bound water and/or what is really present in-situ. But when a correction for bound water is made to the total water content, the calculated properties are changed. Gas porosity will always increase; porosity and saturation will always decrease. A case example illustrating all four techniques is presented. 8 refs., 2 figs., 4 tabs.

4503 Nuclear Explosion Detection

5814 (AD-A–211548/3/XAB) **Seismic-wave attenuation and yield determination at regional distances. Final report, 1 May 1987-30 April 1989.** Mitchell, B.J.; Nuttli, O.W.; Xie, J.K.; Al-Shukri, H.; Correig, A. Saint Louis Univ., MO (USA). 25 May 1989. 131p. Available from NTIS, PC A07/MF A01.

Work was completed on yield determination at the Soviet test site on Novaya Zemlya. Magnitudes and yields, determined for 30 explosions using Lg amplitudes recorded in northwestern Europe, ranged between 2.5 and 4900 kt, the largest since April 1976 being about 145 kt. Studies were completed on seismic wave attenuation of surface waves at intermediate periods and of Lg waves at 1 Hz in several regions of the world. Limits were determined for the degree of frequency dependence of Q (sub beta) which can occur in the crust in stable and tectonically active regions. A stochastic convolution model was proposed for Lg coda at distances > 200 km which considers the effects of dispersion scattering and mode conversions at those distances. A back-projection tomographic method was developed to regionalize large-scale lateral variations of coda Q for Lg waves which traverse long continental paths. A seismically active region in the New Madrid seismic zone was found to be characterized by lower than normal Q values. In the western United States, Q values in the upper mantle vary laterally, becoming smaller from east to west. Crust of the Basin and Range province has a low-Q upper crust overlying a lower crust with higher Q values.

4505 Strategic Defense Initiative

5815 (AD-A–211314/0/XAB) **ISI's (Information Sciences Institute) SDI (Strategic Defense Initiative) architecture simulator: An experiment in adding new software to the system. Research report.** Carter, S.; Mizell, D. University of Southern California, Marina Del Rey, CA (USA). Information Sciences Inst. Jul 1989. 14p. (ISI/RR–89-223). Available from NTIS, PC A03/MF A01.

The design of ISI's SDI architecture simulator was intended to minimize the software development necessary to add new simulation models to the system or to refine the detail of existing ones. The key software design approach used to accomplish this goal was the modeling of each simulated defense system component by a software object called a 'technology module.' Each technology module provided a carefully defined abstract interface between the component model and the rest of the simulation system, particularly the simulation models of battle managers. This report documents the first test of the validity of this software design approach. A new technology module modeling a kinetic kill vehicle' (KKV) was added to the simulator. Although this technology module had an impact on several parts of the simulation system in the form of new data structures and functions that had to be created, the integration of the new module was accomplished without the necessity of replacing any existing code.

5816 (AD-A–211325/6/XAB) **ISI's (Information Sciences Institute) SDI (Strategic Defense Intiative) architecture simulator: Initial prototype user interface. Research report.** Coatney, S.; Mizell, D. University of Southern California, Marina Del Rey, CA (USA). Information Sciences Inst. Jul 1989. 20p. (ISI/RR–89-225). Available from NTIS, PC A03/MF A01.

This report describes the software design of the initial prototype user interface for the strategic defense architecture simulation system at ISI. The user interface was designed to satisfy several requirements. First, it should provide a means for the contractors to easily specify new simulation parameters, including candidate defense system architectures and threat scenarios. Second, it should not be necessary for users to be familiar with the internal workings of the simulator in order to execute the simulator and examine the simulation results. The report documents the design and implementation and its software components, and example interactive session to demonstrate use of the system, and some suggestions for future improvements to the software.

5817 (UCRL–100496) **Design limitations on ultra-high velocity projectile launchers.** Glenn, L.A. (Lawrence Livermore National Lab., CA (USA)). Lawrence Livermore National Lab., CA (USA). 1 Jun 1989. 22p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-891214–2: Hypervelocity impact symposium, San Antonio, TX (USA), 12-14 Dec 1989). Order Number DE89012933. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The maximum velocity attainable in a gasdynamic gun is limited by the maximum sound speed in the driver gas. For a conventional 2-stage light gas gun, the limit is ~10 km/s. Higher velocities are possible, but probably not without the destruction of the gun barrel. As long as this occurs on a time scale longer than the residence time of the projectile, a useful system may still result. Using a newly developed computer code called IGUN, we have evaluated the performance of several multistage designs capable of achieving ultra-high projectile velocities. The main problem is in maintaining the integrity of the projectile. Our calculations indicate that 20 km/s should be achievable without fracturing the projectile. If it is only required to retain near original areal density, velocities in excess of 30 km/s appear feasible. 11 refs., 9 figs.

54 ENVIRONMENTAL SCIENCES

5401 Environmental Sciences, Atmospheric

Refer also to citation(s) 4591, 4592, 4885, 5193, 5233, 5340, 5850, 5860, 5861, 5862, 5863, 5873, 5883, 5884

5818 (BFR-D–17-1989) **Air quality, heating and cooling of buildings: Final report on IEA Workshop.** Andersson, J.V. (ed.). Swedish Council for Building Research, Stockholm (Sweden). 1989. 96p. Project BFR-881054-0. (CONF-8809426–: IEA workshop on air quality, heating and cooling of buildings, Goeteborg (Sweden), 12-14 Sep 1988). Available from Available from: Swedish Council for Building Research, Stockholm (SE).

Restricted distribution, only available for IEA-participating countries.

The sick building syndrome and inferior indoor air quality have been identified as a problem often related to unsuitable building heating and cooling systems. It is a holistic problem and must be dealt with holistically. The purpose of the workshop was to review current international research, development, and demonstration (RD and D) activities in air quality, heating and cooling of buildings technologies and to identify important RD and D needs. This information is beneficial to the IEA in its role of developing opportunities for RD and D collaboration among IEA member nations. The workshop identified an increasing lack of acceptable indoor air quality and thermal comfort in buildings. The systems used for heating and cooling of buildings sometimes lead to inferior air quality and unnecessary high energy consumption due to lack of overall view of the problems. Research, Development and Demonstration projects for better heating and cooling installations in buildings must therefore have energy efficiency and good indoor air quality as prime goals. Most problems identified, and lacking proper solutions, are common to many IEA countries, even if some of the problems are restricted to those countries having similar climatic conditions.

5819 (CEGB-RD/L–3380/R88) **Plume tracer experiments at Hinkley Point 'A' [Nuclear Power Station] during 1987.** Foster, P.M. Central Electricity Research Labs., Leatherhead (UK). Nov 1988. 38p. Order Number DE90609831. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The results of the first part of a programme of plume dispersion measurements at the Hinkley Point Nuclear Power Station are described. Using SF_6 gas and pyrotechnic smoke tracer techniques developed during an earlier study at Oldbury, measurements of ground level plume behaviour out to about 4 km and elevated plume behaviour out to about 1 km have been made in a series of

twelve 1 hour trials and one 15 minute trial. Whereas the Oldbury study considered passive emissions, attention in this study has been focussed on the behaviour of the buoyant shield cooling air emission. Data on plume rise and the degree of plume entrainment by the building wake and on the effects of entrainment and wind meander on plume width and concentration, are presented and discussed in relation to current modelling recommendations. A limited number of 10 minute averaged measurements of plume concentration and 41-Ar decay gamma count were also made at 2 km range and their correlation and variability examined. (author).

5820 (CONF-891098–4) **Global climate change and NEPA (National Environmental Policy Act) analyses.** Cushman, R.M.; Hunsaker, D.B. Jr.; Salk, M.S.; Reed, R.M. Oak Ridge National Lab., TN (USA). [1989]. 25p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From The scientific challenge of NEPA: future directions based on 20 years of experience; Knoxville, TN (USA); 24-27 Oct 1989. Order Number DE90003704. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Energy production and use, industrial activity, and land-use change are expected to cause a global climate change that would have local and regional manifestations during the next century. Although the resulting impacts are not yet known with certainty, potential effects on agriculture, water, forests, ecosystems, fisheries, coastal areas (from rising sea level), and other environmental resources have been predicted. The National Environmental Policy Act of 1969 (NEPA) provides for consideration of such topics as global climate change. However, the implementation of the environmental impact statement (EIS) requirements of NEPA has seldom been used to address the issue. Climate change and its consequent effects have three important implications for NEPA determinations: (1) the potential for an action to individually alter climate must be assessed, (2) cumulative impacts of the action in concert with other actions must be considered, and (3) the potential for future climate change to alter the "baseline" environment (and thus to affect the action or to alter the impact of the action) must be assessed, even if the action under consideration will not in itself contribute to climate change. In this paper, we evaluate the climate-change issue (including the uncertainty of the temporal and spatial distribution of impacts) in a NEPA context. We discuss the kinds of actions to which NEPA is applicable, the types of analyses that might be appropriate, and the problems they might involve. In particular, the opportunities and limitations under current Council on Environmental Quality regulations for addressing climate change through the environmental assessment (EA)/EIS process are addressed. We also discuss changes that have been proposed for NEPA and its implementing regulation and how they could affect the analysis of global climate change. 32 refs., 3 tabs.

5821 (CONF-8911110–2) **Responding to the threat of global warming: Options for the Pacific and Asia.** Bhatti, N. (Argonne National Lab., IL (USA)); Streets, D.G.; Siddiqi, T.A. Argonne National Lab., IL (USA). [1989]. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Symposium on environmental perspectives towards the year 2000 and beyond; Bangkok (Thailand); 6-10 Nov 1989. Order Number DE90003553. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

During the past few years, global climate change has rapidly been transformed from an esoteric topic of interest mainly to scientists to one of worldwide concern to policymakers, the business communities, the media, and the general public. In response to this heightened interest, a number of high-level international meetings dealing with this issue have been held in the past two years. With growing recognition that the global climate change phenomenon would result in different regional (and local) effects, a workshop was organized by Argonne National Laboratory and the East-West Center to assess the likely consequences of this threat and the possible remediation options available to the countries of the Pacific Asia. This paper summarizes the deliberations and conclusion of the workshop, which was held at the East-West center in Honolulu, Hawaii, from June 21–27, 1989. 35 refs., 4 figs.

5822 (DOE/ER–0406) **Global distribution of total cloud cover and cloud type amounts over the ocean.** Warren, S.G. (Washington Univ., Seattle, WA (USA). Dept. of Atmospheric Sciences); Hahn, C.J.; London, J.; Chervin, R.M.; Jenne, R.L. USDOE Office of Energy Research, Washington, DC (USA). Carbon Dioxide Research Div.; National Center for Atmospheric Research, Boulder, CO (USA). Dec 1988. 421p. Sponsored by U.S. DOE Energy Research. (NCAR/TN–317-STR). Order Number DE90003187. Available from NTIS, PC E19/MF E09 - OSTI; GPO Dep.

This report contains 37 microfiche supplements.

This is the fourth of a series of atlases to result from a study of the global cloud distribution from ground-based observations. The first two atlases (NCAR/TN-201+STR and NCAR/TN-241+STR) described the frequency of occurrence of each cloud type and the co-occurrence of different types, but included no information about cloud amounts. The third atlas (NCAR/TN-273+STR) described, for the land areas of the earth, the average total cloud cover and the amounts of each cloud type, and their geographical, diurnal, seasonal, and interannual variations, as well as the average base heights of the low clouds. The present atlas does the same for the ocean areas of the earth.

5823 (DOE/ER/60314–T1) **Second year progress report on research project on CO_2-induced climate change.** Cess, R.D.; Hameed, S. State Univ. of New York, Albany, NY (USA). Research Foundation. [1989]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-85ER60314. Order Number DE90003531. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The following pages summarize the work completed to date in the second year of the Research Project on CO_2-Induced Climate Change which is funded by the Department of Energy. The three major areas of study are discussed separately. The first task deals with an intercomparison of general circulation model capabilities with the aim of improving their parameterizations of important physical processes, so that model predictions of CO_2 induced climate change become more reliable. Task 2 encompasses analysis of climate data for the purpose of understanding climate change and climate variability. The third task is concerned with analyzing climatic variability in General Circulation Models and its comparison with observations.

5824 (DOE/ET/10815–131) **Dispersion modeling for the Coal-Fired Flow Facility.** Casey, J.L.; Holt, J.K. Tennessee Univ., Tullahoma, TN (USA). Space Inst. [1989]. 8p. Sponsored by U.S. DOE Fossil Energy. DOE Contract AC02-79ET10815. (CONF-891226–1: 10. international conference on MHD electrical power generation, Tiruchirapalli (India), 4-8 Dec 1989). Order Number DE89015803. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The application of dispersion models developed for the Coal Fired Flow Facility CFFF has illustrated agreement between predicted and measured concentrations at the ambient air monitoring sites. Applications of the model have resulted in a straightforward graphic representation of plume behavior and terrain interactions with the dispersion process. The modelling efforts have provided insight into the complexities of wind field variations and their resultant influence on pollutant dispersion. 6 refs., 11 figs.

5825 (DOE/RL–89-12) **Hanford Site grundwater protection management program.** Westinghouse Hanford Co., Richland, WA (USA). Oct 1989. 102p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. Order Number DE90003494. Available from NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.

Groundwater protection has emerged over the past few years as a national priority that has been promulgated in a variety of environmental regulations at both the state and federal level. In order to effectively coordinate and ensure compliance with applicable regulations, the US Department of Energy (DOE) requires all DOE facilities to prepare separate groundwater protection program descriptions and plans (groundwater activities were formerly included as a subpart of environmental protection programs). This document is for the Hanford Site located in the state of Washington. The DOE Order specifies that the groundwater protection management program cover the following general topical areas: (1) documentation of the groundwater regime, (2) design and implementation of a groundwater monitoring program to support resource management and comply with applicable laws and regulations, (3) a management program for groundwater protection and remediation, (4) a summary and identification of areas that may be contaminated with hazardous waste, (5) strategies for controlling these sources, (6) a remedial

action program, and (7) decontamination and decommissioning and related remedial action requirements. 14 refs., 19 figs., 2 tabs.

5826 (ENEA-RT-PAS--89-11) **Torre Valdaliga (Civitavecchia, Italy) fossil-fuel power plants: Effects on composition of local precipitations.** Bargagli, R.; Morabito, R.; Basili, N.; Tidei, F. ENEA, Casaccia (Italy). Dipt. Protezione Ambientale e Salute dell'Uomo. Jun 1989. 28p. (In Italian). Order Number DE90724612. Available from NTIS (US Sales Only), PC A03/MF A01.

Data from wet deposition sampling over an area near Civitavecchia (Italy) fossil-fuel power plants are here presented and discussed. In order to establish the possible influence of the power plants emissions on the chemical composition of the rain collected, the data were correlated with synoptic and local meteorological conditions.

5827 (INIS-mf--11562, pp. 50) **Comparison of atmospheric aerosol contamination with artificial radionuclides in two localities.** Navarcik, I. (Ustav Radioekologie a Vyuzitia Jadrovej Techniky, Kosice (Czechoslovakia)); Wirdzek, S. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118--: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. AEROSOL MONITORING/ surface air; AEROSOLS; CONTAMINATION; FALLOUT; RADIATION MONITORING; RADIOACTIVITY; RADIOISOTOPES

5828 (INIS-mf--11562, pp. 47) **Optimizing measurement of radon daughter concentration.** Mino, J. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni); Thomas, J. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118--: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. DAUGHTER PRODUCTS/ radiation monitoring; RADON/daughter products; OPTIMIZATION; QUANTITY RATIO; RADON; SURFACE AIR

5829 (INIS-mf--11562, pp. 48) **Radon in ground air - properties and measurement.** Moucka, L. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni). Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118--: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. RADON/natural radioactivity; RADIATION MONITORING; RADIATION PROTECTION; RADON

5830 (INIS-mf--11562, pp. 62) **Artificial radionuclide levels in Prague air in the years 1986 to 1988.** Rulik, P. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni); Bucina, I.; Malatova, I.; Kuca, P.; Drabova, D.; Machacek, K.; Brezik, Z.; Filgas, R.; Hoelgye, Z.; Peskova, V. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118--: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. RADIATION MONITORING/ surface air; SURFACE AIR/radioactivity; CESIUM 134; CESIUM 137; CHERNOBYLSK-4 REACTOR; FILTERS; GAMMA SPECTROSCOPY; PLUTONIUM 239; PLUTONIUM 240; RADIATION ACCIDENTS; RUTHENIUM 106; STRONTIUM 90; RADIOACTIVITY; TIME DEPENDENCE

5831 (INIS-mf--11562, pp. 66) **Natural radioactivity in nursery schools.** Skokanova, K. (Krajska Hygienicka Stanice, Prague (Czechoslovakia)); Rothova, A. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118--: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. EDUCATIONAL FACILITIES/ natural radioactivity; RADON 222/buildings; CHILDREN; DOSE RATES; BUILDINGS

5832 (INIS-mf--11562, pp. 81) **Is it necessary to measure thoron levels in appartments in addition to radon levels?.** Thomas, J.; Moucka, L.; Mino, J. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118--: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. RADON 220/buildings; RADON 222/buildings; BUILDINGS

5833 (INIS-mf--11562, pp. 23) **Experience with mathematical models in assessing environmental contamination.** Horyna, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118--: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. RADIONUCLIDE MIGRATION/ mathematical models; CONTAMINATION; ENVIRONMENT; ENVIRONMENTAL EXPOSURE PATHWAY; RADIATION ACCIDENTS; RELIABILITY; WASHOUT

5834 (KFK--4520) **Wind measurements with SODAR during strong temperature inversions near the ground.** Thomas, P.; Vogt, S. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Meteorologie und Klimaforschung. Aug 1989. 30p. (In German). Order Number DE90729137. Available from NTIS (US Sales Only), PC A03/MF A01.

SODAR (Sound Detection and Ranging) equipment has been increasingly used to measure vertical wind profiles with little expenditure in terms of staff, continuously over time and with a good spatial resolution. These informations serve as input variables for atmospheric transport and dispersion models, environmental monitoring of industrial facilities and, generally, for investigating a broad spectrum of meteorological phenomena. The SODAR principle has proved its suitability since long provided that the data recorded with SODAR have served to establish wind statistics valid for extended

periods of time. At industrial sites potentially releasing substances prejudicial to health, e.g., chemical plants, nuclear power plants, etc., a SODAR must, moreover, be capable of measuring reliable the wind conditions also during short periods of release. This would, e.g., be important during accidental releases. Especially interesting situations for pollutant dispersion are distinct temperature inversions. It will be examined in this paper whether a SODAR is capable of measuring reliably the wind conditions also during those inversions. The selection of the situations of inversion as well as the direct intercomparison of data supplied by SODAR and conventional wind measuring instruments (anemometer and wind vane) are possible at the 200 m meteorological tower erected at the Karlsruhe Nuclear Research Center. The comparison between SODAR and the meteorological tower has shown that a SODAR is able to measure reliably the wind data also in situations characterized by strong ground-based and elevated inversions, respectively. (orig./KW).

5835 (ORNL/FTR–3432) **[Nitrogen deposition to forest trees]: Foreign trip report, September 30, 1989–October 13, 1989.** Taylor, G.E. Jr.; Hanson, P.J. Oak Ridge National Lab., TN (USA). 6 Oct 1989. 19p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90003285. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The travelers participated in two major international conferences focusing on the interaction between the atmosphere and vegetation in terrestrial ecosystems. The first addressed the issue of forest decline, whereas the second focused on controlled-environment methodologies for characterizing the influence of physical and chemical changes in the atmosphere on crops and forest trees. Both travelers presented posters at the first meeting and at the second delivered invited contributions and chaired sessions. Each traveler visited several research sites in southern Germany. Observations from both conferences and the site visits are summarized.

5836 (ORNL/FTR–3468) **[Acid rain research]: Foreign trip report, October 26–November 6, 1989.** Gardner, R.H. Oak Ridge National Lab., TN (USA). 15 Nov 1989. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90003283. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This report describes the foreign travel of Robert H. Gardner of the Environmental Sciences Division (ESD), Oak Ridge National Laboratory (ORNL), who was invited by The Free University, Amsterdam, to participate in the presentation and defense of the doctoral thesis of Jean-Paul Hettelingh. The opportunity to visit The Netherlands also allowed the traveler to confer with Dr. M.B. Beck at The Imperial College, London; to present a lecture on the theory and methods of assessing the uncertainties associated with environmental models to the Institute for Environmental Studies (IVM) at The Free University; to confer with scientists at The National Institute of Public Health and Environmental Protection (RIVM) at RIVM headquarters in Bilthoven and present a seminar on recent developments in theoretical ecology; and to confer with Dr. Paul Opdam and Jana Verboom of the Research Institute for Nature Management (RIN) concerning our similar research activities in landscape ecology.

5837 (ORNL/FTR–3483) **[Long-range transboundary air pollution]: Foreign trip report, November 2–13, 1989.** Hunsaker, C.T. Oak Ridge National Lab., TN (USA). 28 Nov 1989. 7p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC05-84OR21400. Order Number DE90003476. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The traveler participated in the United Nations Workshop on Mapping Critical Levels/Loads, which produced a draft mapping manual that will be used by Parties to the Convention of Long-Range Transboundary Air Pollution. The traveler made significant contributions to two groups during the workshop: (1) the group addressing the mapping of critical loads for natural vegetation, forests, soils, and aquatic ecosystems and (2) the overall synthesis and coordination group.

5838 (PB–89-221238/XAB) **Technical issues related to emission releases from subslab radon mitigation systems.** Sanchez, D.C. Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab. Mar 1989. 14p. (EPA–600/D-89/078). Available from NTIS, PC A03/MF A01.

This paper presents a preliminary review of the literature and an estimation of the range of dilutions that are possible for roof-top and elevated side-of-house emission releases. Operating characteristics of typical subslab systems are used with estimated diluations to assess possible emissions reentrainment and downwind effects on houses. Surveys of government and private sector radon-mitigation activities indicate that subslab radon-mitigation systems account for more than 50% of all installed systems. While ongoing mitigation research and demonstration projects show promise for optimizing system designs in the future, current practice relies on the installation of robust (effective oversized) systems. Such systems can remove large quantities of radon-laden soil gas from underneath and from around mitigated houses.

5839 (PB–89-224489/XAB) **Statistical evaluation of the performance of the TEM (transmission electron microscopy) clearance procedure.** Chesson, J.; Rosenberg, J. Price Associates, Washington, DC (USA). Jul 1989. 45p. Available from NTIS, PC A03/MF A01.

EPA has evaluated the performance characteristics of the three-step clearance procedure under a variety of conditions with the use of a negative binomial distribution to describe the statistical distribution of asbestos fiber concentrations and the Z-test to perform the inside-outside comparisons. The main results of this evaluation of the proposed Transmission Electron Microscopy clearance procedure are: The false negative error rates are lower when the underlying statistical distribution of airborne asbestos concentrations follows a lognormal distribution. Of the four inside/outside comparison tests, the Poisson test has the lowest false negative error rates, but also has the highest false positive rates. Sampling the minimum volume of air increases the false negative error rate, particularly at airborne asbestos concentrations less than 0.06 f/cu cm. Counting only fibers longer than 0.5 micrometers and with an aspect ratio of 5:1 or greater may increase or decrease decision error rates.

5840 (PB–89-228977/XAB) **Air-quality investigation in the NIH (National Institutes of Health) Radiation Oncology Branch.** Persily, A.; Dols, W.S.; Nabinger, S.J.; VanBronkhorst, D.A. National Inst. of Standards and Technology (NEL), Gaithersburg, MD (USA). Center for Building Technology. Aug 1989. 132p. (NISTIR–89/4145). Available from NTIS, PC A07/MF A01.

The Radiation Oncology Branch (ROB) is located in the Clinical Center of the National Institutes of Health (NIH). The occupants of the ROB facility have expressed dissatisfaction with the air-quality within the facility for several years. To identify the sources of the air quality problems in the ROB facility and to obtain recommendations for their solution, the Center for Building Technology at the National Institute of Standards and Technology (NIST, formerly The National Bureau of Standards) conducted an indoor-quality investigation of the ROB facility. Results revealed several deficiencies in the design and current condition of the ROB ventilation system, such as significant differences between the design airflow rates and those recommended in current standards and guidelines. The airflow measurements showed many instances in which measured airflow rates were different from their design values and revealed the existence of airflows leading to the potential for pollutant transport within the building. The contaminant measurements fell generally well below the maximum values in the ASHRAE air-quality standard. Thermal-comfort measurements revealed instances when the temperature and relative humidity were outside of ASHRAE comfort limits. Recommendations are made to remedy the deficiencies noted and to control the conditions contributing to the building's air-quality problems.

5841 (RFP–4380) **Program plan for the development, evaluation, and application of the Terrain-Responsive Atmospheric Code (TRAC).** Hodgin, C.R.; Brown-Strattan, M.A.; Ladman, R.W. Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant. 6 Oct 1989. 56p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP03533. Order Number DE90003761. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The Department of Energy (DOE) maintains a number of atmospheric dispersion models at several facilities. DOE applies modeling for Risk Assessment, Emergency Response, and Regulatory Compliance. The Rocky Flats Plant is developing a dispersion/dose code to meet DOE and other governmental requirements for

dispersion modeling at the Rocky Flats Plant. The Terrain-Responsive Atmospheric Code (TRAC) is designed to realistically simulate the involved atmospheric conditions that occur around complex sites such as the Rocky Flats. Our approach complements the fundamental research programs at DOE National Laboratories and other facilities. Proven research results are quickly transferred from the literature to applied use. In this way, the benefits of DOE-funded basic research are most rapidly realized. 16 refs., 22 figs., 13 tabs.

5842 (UCRL–101837) **Greenhouse gases: Changing the global climate.** MacCracken, M.C. Lawrence Livermore National Lab., CA (USA). Sep 1989. 20p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8908182–1: 9. session of the international seminars on nuclear war, Erice (Italy), 19-24 Aug 1989). Order Number DE90002788. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The increasing atmospheric concentrations of carbon dioxide and other radiatively active gases will enhance the ability of the atmosphere to trap infrared radiation and thereby lead to warming of the climate. Numerical models suggest that the global average surface air temperature can be expected to increase a few degrees during the twenty-first century. This estimate is probably uncertain by a factor of at least two. The uncertainties in estimates of regional changes of temperature and precipitation are even greater. Despite these uncertainties, there is broad agreement that the persistence of such changes would be unprecedented in historical times. To moderate the projected climatic and environmental changes, the rate of emissions of greenhouse gases must be slowed while alternative energy technologies are developed. 31 refs., 1 tab.

5843 (WSRC-RP–89-793) **Phase I characterization of the HEPA (High Efficiency Particulate Air) filter media used in the airborne activity confinement system at the Savannah River Site.** Novick, V.J. (Argonne National Lab., IL (USA)); Higgins, P.J. Westinghouse Savannah River Co., Aiken, SC (USA); Argonne National Lab., IL (USA). [1989]. 71p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. Order Number DE90003502. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

The purpose of this report was to characterize the HEPA filter media material. This work consisted of two major tasks. First, the pressure drop characteristics of the HEPA filter material were measured as a function of the aerosol mass loading. Particle size effects were studied by using three different particle size distributions to load the filter material. The second task was to determine the filtration efficiency spectrum for solid particles as a function of particle diameter. The filtration efficiency was measured at two different media velocities, one corresponding to the equivalent flow rate under normal operating conditions, the other corresponding to the minimum equivalent flow rate expected through the filter compartments. These tests were conducted at the Argonne National Laboratory between September 1988 and February 1989. 20 refs., 31 figs., 10 tabs.

5844 **Global energy and the greenhouse issue.** Scott, M.J. (Battelle Pacific Northwest Laboratory (USA)); Edmonds, J.A.; Kellogg, M.A.; Schultz, R.W. vp. of World Energy Conference 14th congress: energy for tomorrow. Organizing Committee of the 14th WEC Congress, Quebec, CA (1989). (CONF-890901–: 14. world energy conference, Montreal (Canada), 17-22 Sep 1989).

Global energy production and use results in the release of CO_2 and other gases to the atmosphere which affect the atmosphere's radiative character. The accumulation of CO_2 and other radiatively important gases (RIGs) is thought to result in higher mean global surface temperatures and other climatic changes, whose character would vary regionally around the globe. Of critical importance to determining the timing and magnitude of global climate change is an understanding of long-term global energy systems. This paper will document the current understanding of the relationship between human activities, energy, CO_2 and other RIGs, survey the global greenhouse forecast literature, and give some assessment of forecast uncertainty. 20 refs., 3 tabs.

5845 **Recovering CO_2 from large stationary combustors.** Wolsky, A.M. (Argonne National Laboratory, IL (USA). Energy and Environmental Systems Division); Brooks, C. pp. 656 of Energy technologies for reducing emissions of greenhouse gases. Volume 2. OECD/IEA, Paris, France (1989). (CONF-8904158–:).

Argonne National Laboratory has conducted research on a new approach to recovering carbon dioxide from stationary combustors. This research is aimed at providing the private sector with the information it needs to decide whether the approach can contribute to future supplies of carbon dioxide for enhanced oil recovery. The approach includes the simultaneous recovery of other gaseous combustion products, such as oxides of sulfur and oxides of nitrogen. The product stream, essentially all carbon dioxide, could be used for enhanced oil recovery. The approach also may find application where strict air pollution controls are mandated. Concern for the Greenhouse Effect prompts the wish to sequester CO_2 after having recovered CO_2. 8 refs.

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Refer also to citation(s) 4597, 4600, 4602, 4603, 4604, 4605, 4606, 4607, 4608, 4609, 4610, 4612, 4613, 4614, 4615, 4616, 4617, 4618, 4619, 4620, 4621, 4622, 4623, 4624, 4625, 4626, 4627, 4628, 4629, 4630, 4699, 4800, 4847, 4911, 4916, 4958, 5194, 5556, 5786, 5888, 5893

5846 (ANL/EAIS/TM–1) **A comparison of global climate change legislation in the 101st Congress.** Hootman, H.A.; South, D.W. Argonne National Lab., IL (USA). Environmental Assessment and Information Sciences Div. Sep 1989. 60p. Sponsored by U.S. DOE Fossil Energy. DOE Contract W-31109-ENG-38. Order Number DE90004419. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This report compares bills introduced during the flurry of global climate change legislative activity that accompanied the commencement of the 101st Congress. The bills represent an assortment of policies proposed to mitigate global climate change, ranging from regulatory approaches that require immediate emission reductions to strictly administrative approaches that coordinate research efforts. A parallel report comparing bills in the 100th Congress preceded this report. These informal reports have been sponsored by the US Department of Energy (DOE), Office of Fossil Energy.

5847 (BR–82(11.114)) **Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic): Atlantic marsh fiddler.** Grimes, B.H. (North Carolina Cooperative Fishery Research Unit, Raleigh, NC (USA)); Huish, M.T.; Kerby, J.H.; Moran, D. Army Engineer Waterways Experiment Station, Vicksburg, MS (USA). Coastal Ecology Group; Fish and Wildlife Service, Washington, DC (USA); North Carolina Cooperative Fishery Research Unit, Raleigh, NC (USA); National Wetlands Research Center, Slidell, LA (USA). Sep 1989. 18p. Sponsored by U.S. Department of the Interior. (TR-EL–82-4/82(11.114)). Available from OSTI; Fish and Wildlife Service, NASA-Slidell Computer Complex, 1010 Gauss Boulevard, Slidell, LA 70458.

The Atlantic marsh fiddler is the only endemic species of Uca in the Mid-Atlantic region. Males display a series of visual and acoustical displays during mating, with a weak waving and bleaching of the larger claw. Egg clutch size in female varies. Larvae are released in phase with nocturnal high tides. The 5 zoeal and 1 megalops stages compose much of the estuarine plankton. First and second crab stages are weak and unable to burrow. Adult lifespan is 1–1.5 years with 1–2 molts per year. Molting is temperature dependent and ceases below 20°C. Crabs feed by scrubbing the preferred muddy substratum for diatoms, fungi, vascular plants, and debris, bioturbating and recycling the marsh surface. This crab is eaten regularly by estuarine birds, fish, crabs, and some mammals. This fiddler can acclimate to lower temperatures, but dies below 2-3°C or above 40°C. It prefers seawater, lacking freshwater tolerance. Oxygen uptake correlates with activity. Preferred habitats are muddy substrata and short smooth cordgrass. Burrow density decreases from low to high marsh. The Atlantic marsh fiddler has the highest radiation LD-50 of sympatric species of fiddler crabs. Insecticides Temefos, DDT, DDF, Aldrin, and Dieldrin, and contaminant PCB's, mercury, and cadmium reduce populations of fiddlers, some being concentrated in their tissues. 90 refs., 4 figs.

5848 (CONF-891098–2) **Ecological assessments at DOE hazardous waste sites: Current procedures and problems.** Hlohowskyj, I.; Krummel, J.R.; Irving, J.S.; Vinikour, W.S. Argonne National Lab., IL (USA). 1989. 23p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract W-31109-ENG-38. From The scientific challenge of NEPA: future directions based on 20 years of experience; Knoxville, TN (USA); 24-27 Oct 1989. Order Number DE90003196. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Major actions at US Department of Energy (DOE) hazardous waste sites require CERCLA compliance that meets NEPA considerations. Although NEPA compliance includes ecological considerations, neither the Council on Environmental Quality (CEQ) nor the DOE provide detailed guidance for conducting ecological assessments under NEPA. However, the identification of the form and magnitude of potential ecological impacts associated with a proposed action is directly dependent on the quality of the baseline data available for a particular site. Using the Surplus Facilities Management Program Weldon Spring site as an example, we discuss the collection of baseline ecological data for the site. This site is surrounded by approximately 17,000 acres of wildlife area. Available wildlife data consisted of qualitative, county-level species lists, and vegetation data was in the form of a regional qualitative narrative. Detailed site-specific occurrence data for listed species and high quality natural communities was provided by the Missouri Department of Conservation Heritage data base. 30 refs., 1 fig., 1 tab.

5849 (CPS–EPS3/HA/5) **The evaluation of mobile and stationary facilities for the destruction of PCBs.** Piersol, P. (ORTECH Corp. (Canada)). Environment Canada, Ottawa, ON (Canada). Conservation and Protection. May 1989. 128p. (MICROLOG–89-03960). Available from PC Environment Canada. Environmental Protection Publications, 10 Wellington St., 12th PVM, Ottawa, ON, CAN K1A 0H3; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This report provides an up-to-date appraisal of polychlorinated biphenyl(PCB) destruction technologies. Over 60 companies and organizations were surveyed to obtain information on processes that destroy PCBs contained in both liquid and solid wastes. The information was reviewed, the technologies evaluated and the status of each technology identified as commercial, near-commercial or promising. Stationary rotary kiln incineration with flue gas treatment has been proven commercially at several U.S. and European facilities. Three stationary industrial hazardous waste facilities which will incinerate PCB wastes are under developmnt in Canada. Eight North American companies were identified that offer near-commercial mobile/transportable destruction technologies. Mobile, sodium-based and PEG/KOH (poly(ethylene glycols)/potassium hydroxide) processes for the decontamination of PCB-contaminated oil are considered proven commercial PCB destruction technologies. Four companies operate mobile facilities using PCB-contaminated oil dechlorination technologies in Canada. Promising technologies for the treatment of PCB solid wastes are low-temperature oxidation, chlorine removal, vitrification, bidegradation and thermal extraction. 15 refs., 7 tabs.

5850 (DOE/RL–89-18) **United States Department of Energy – Richland Operations Office Environmental Protection Implementation Plan, November 9, 1989 to November 9, 1990.** Paasch, R.A. Westinghouse Hanford Co., Richland, WA (USA). Nov 1989. 56p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-87RL10930. Order Number DE90003493. Available from NTIS, PC A04/MF A01; OSTI; INIS; GPO Dep.

Protection of the environment at the Hanford Site is being ensured through several dedicated activities. These dedicated activities include: Routine effluent monitoring to ensure operations control emissions to the environment and environmental surveillance to characterize and assess impacts of operations on the environment; Corrective activities including permitting of facilities and upgrading of systems to come into full compliance with environmental regulations; Activities for maintaining compliance with federal and state statutes regulating both active and inactive waste sites; Environmental restoration activities for cleanup of inactive sites; Oversight activities to ensure conduct of responsive and integrated programs for environmental protection; and Recognition of additional requirements of new or revised regulations and DOE orders and implementation of means for meeting these requirements.

5851 (DOE-RW–88.032) **Groundwater movement through mudrocks - measurement and interpretation.** Brightman, M.A. (British Geological Survey, Keyworth (UK). Fluid Processes Research Group); Alexander, J.; Gostelow, T.P. Department of the Environment, London (UK). Dec 1987. 68p. (FLPU–87-1). Order Number DE90609793. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

The parameters which require measurement to determine the fluxes through mudrocks are groundwater head, hydraulic conductivity, porosity, tortuosity, groundwater chemistry, and the semi-permeable membrane properties of the mudrock. A series of measurements have been made at the Harwell Research Site to assess the occurrence and magnitude of the different fluxes across mudrocks. Head measurements have been made through perforations in the mudrocks, and the results broadly fit the previously conceived groundwater flow pattern. Measurement of the chemical potential of groundwaters is straightforward in the aquifers but more difficult in the mudrocks. If mudrocks do not behave as semi-permeable membranes then diffusion will be a more important solute transport process than advection. If mudrocks behave as ideal semi-permeable membranes the relative magnitude of advective and osmotic groundwater flows is largely dependent on the chemical potential gradient. If mudrocks behave as non-ideal semi-permeable membranes then the relative importance of the mechanisms is chiefly determined by the degree of ideality of the membrane. (author).

5852 (DOE-RW–88.105) **Desk study of surface diffusion and mass transport in clay.** Cook, A.J. (British Geological Survey, Keyworth (UK). Fluid Processes Research Group). Department of the Environment, London (UK). Sep 1988. 38p. Order Number DE90609794. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The concept of a geological barrier to radionuclide migration from theoretical radioactive waste repositories has drawn attention to the physico-chemical properties of clays, which are traditionally regarded as retarding media. This report addresses the different mechanisms of transport of radionuclides through clay and in particular focuses on the surface diffusion movement of sorbed cations. The relative contributory importance of the different transport mechanisms is governed by the pore size distributions and interconnections within the clay fabric. Surface diffusion data in the literature have been from experiments using compacted montmorillonite and biotite gneiss. A possible programme of laboratory work is outlined, based on diffusion experiments, which describes the way of measuring the effect of surface diffusion more accurately in clays, mudstones and shales. (author).

5853 (DOE-RW–89.005) **Geochemical modelling of the Broubster natural analogue site, Caithness, Scotland.** Read, D. (Atkins (W.S.) and Partners, Epsom (UK)). Department of the Environment, London (UK). Nov 1988. 50p. Order Number DE90609819. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The work described here forms part of an on going programme of research into natural radionuclide migration, and is primarily aimed at improving confidence in predictive models used for radiological assessment. Anomalously high concentrations of uranium, thorium and the rare earth elements (REE) are associated with peat-rich soils near Broubster, northern Scotland. The source of the anomaly has been traced to a hydrocarbon-containing mineralised zone within a uraniferous, calcareous Devonian sedimentary sequence. From there, the elements have been transported approximately 100 metres downslope and fixed within waterlogged peat deposits. The degree of concentration and fractional accompanying actinide transport is extreme. This report describes the results of a theoretical modelling exercise and complementary experimental study carried out to determine the chemical speciation of actinides at the Broubster site. Efforts made to identify mobilisation and retention mechanisms for uranium and thorium have led to the development of a simple model for actinide behaviour in the peat soils. Chemical transport of uranium has been simulated using the directly coupled CHEMTARD program. (author).

5854 (EGG–10617-1010) **An aerial radiological survey of the Braidwood Generating Station and surrounding area, Braidwood, Illinois, August 1988.** EG and G, Inc., Las Vegas, NV (USA). Remote Sensing Lab. Jan 1989. 13p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC08-88NV10617. Order Number DE90003308. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An aerial radiological survey was conducted over the Braidwood Generating Station, Braidwood, Illinois, during the period 5 August through 16 August 1988. The purpose of the 259-square-kilometer (100-square-mile) survey was to document the terrestrial gamma environment of the plant and surrounding area. An exposure rate contour map extrapolated to 1 meter above ground level (AGL) was constructed from the gamma data and overlaid on an aerial photograph and map of the area. Terrestrial-only exposure rates varied from 0 to 8 microroentgens per hour (μR/h). The highest exposure rates were recorded over strip-mined areas. Lower-than-average exposures rates were measured over bodies of water and large paved areas. No areas of enhanced exposure rates due to man-made radionuclides were observed. Ground-based exposure rate measurements and soil samples were obtained to support the aerial data. Oblique aerial photographs of the plant were also acquired during the survey. 9 refs., 5 figs., 1 tab.

5855 (INIS-BR–1687) **Synthesis of leucite, sanidine and a melt of sanidine at 930-1030^{0}C and 2 Kb: partition coefficients of Rb, Ca, Sr and Ba between these phases and hydrothermal solution of KCl. Geological utilizations.** Moreira, A.H.P. Sao Paulo Univ., SP (Brazil). Inst. de Geociencias. 1988. 173p. (In Portuguese). Order Number DE90608124. Available from NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS.

This work shows the results of hydrothermal experiments to determine the distribution coefficients of alcali and alcaline earth elements in trace concentrations between sanidine and liquids of same composition and between leucite and liquid. At 2 Kb pressure and 930^{0}C for sanidine, 930^0 and 1030^{0}C for leucite and 1030^{0}C for a melt of sanidine composition the concentration of trace elements (TE) in the coexisting potassium bearing aqueous fluid phase was varied between 10^{-1} to 10^{-6} mole to one mol of K^+. By use of radioactive tracers (Rb^{86}, Ca^{45}, Sr^{85}, Ba^{133}) the concentrations in TE of the aqueous phase, the solids and melts has been determined. This indirect method will give a good aproximation of the behaviour of TE between a melt and crystallising solids. These aprotimations lead to following conclusions: (a) during the crystallisation of leucite, this phase incorporates large quantities of Ba and Rb, depleting the residual melt in those elements. Sr and Ca, on the other hand are enriched in the residual melt. (b) the crystallisation of sanidine depletes even more the residual melt in Ba, Sr shows similias behaviour, Rb and Ca, however, are enriched in the residual melt phase. (author).

5856 (INIS-BR–1704) **Spikes in alpha spectroscopy for analysing geological samples.** Bonotto, D.M. (UNESP, Rio Claro, SP (Brazil). Dept. de Fisica). UNESP, Rio Claro, SP (Brazil). Inst. de Geociencias e Ciencias Exatas. 1988. 2p. (In Portuguese). (CONF-8809418–: 3. Symposium on Geoscience Quantification, Rio Claro (Brazil), 1-3 Sep 1988). Order Number DE90609798. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only. THORIUM 230/alpha spectroscopy; URANIUM 234/alpha spectroscopy; ISOTOPE DILUTION; ROCKS; TRACE AMOUNTS; URANIUM 235; URANIUM 238

5857 (INIS-mf–11562, pp. 12) **^{85}Sr diffusion in soils.** Cipakova, A. (Ustav Radioekologie a Vyuzitia Jadrovej Techniky, Kosice (Czechoslovakia)); Szabova, T. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary torm only. SOILS/radionuclide migration; STRONTIUM 85/radionuclide migration; DIFFUSION; SALTS; SOILS

5858 (INIS-mf–11562, pp. 13) **Survey of results of measuring radon daughters in buildings in dependence on the year of construction.** Dobiasova, N. (Krajska Hygienicka Stanica, Kosice (Czechoslovakia)); Stromp, L. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. BUILDINGS/radiation monitoring; RADON/buildings; BUILDING MATERIALS; BUILDINGS; DAUGHTER PRODUCTS; RADON

5859 (INIS-mf–11562, pp. 42) **Radioactivity of Czechoslovak ores and dose equivalents due to terrestrial radiation.** Matolin, M. (Karlova Univ., Prague (Czechoslovakia). Prirodovedecka Fakulta). Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. DOSE EQUIVALENTS/background radiation; ROCKS/natural radioactivity; DOSE RATES; GAMMA RADIATION; ROCKS

5860 (INIS-mf–11562, pp. 67) **Unexplained single observation of high concentration of radon daughters in a START type house.** Skokanova, K. (Krajska Hygienicka Stanice, Prague (Czechoslovakia)); Thomas, J.; Filip, J. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. RADON/buildings; DAUGHTER PRODUCTS; ISOTOPE RATIO; RADON; BUILDINGS

5861 (INIS-mf–11562, pp. 68) **Increased concentrations of radon daughters in housing development units on Central Bohemian pluton.** Skokanova, K. (Krajska Hygienicka Stanice, Prague (Czechoslovakia)); Rothova, A.; Thomas, J.; Moucka, L.; Filip, J. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. RADON/urban areas; BUILDINGS; DAUGHTER PRODUCTS; RADIATION MONITORING; RADON

5862 (INIS-mf–11562, pp. 79) **Importance of aerial radiometry and gamma spectrometry for defining risk areas with respect to radon emission from subgrade to residential buildings.** Thomas, J. (Institut Hygieny a Epidemiologie, Prague

(Czechoslovakia). Ustav Hygieny Zareni); Machek, J.; Moucka, L.; Mino, J. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118--: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. AERIAL MONITORING/radon; RADON; BUILDINGS; GAMMA SPECTROSCOPY; NATURAL RADIOACTIVITY; SOILS

5863 (INIS-mf--11562, pp. 80) **Residential building with high gamma dose rate.** Thomas, J. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni); Moucka, L.; Mino, J.; Machek, J. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118--: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. BUILDINGS/gamma radiation; RADIUM 226/buildings; RADON 222/buildings; BUILDINGS; DOSE RATES

5864 (INIS-mf--11562, pp. 8) **^{90}Sr in Czechoslovak cereals from 1986 and 1987 harvests.** Brezik, Z. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni); Beckova, V.; Pickova, L. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118--: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. BARLEY/radiation monitoring; OATS/radiation monitoring; RYE/radiation monitoring; STRONTIUM 90/radioecological concentration; WHEAT/radiation monitoring; BARLEY; CHERNOBYLSK-4 REACTOR; CONTAMINATION; OATS; RADIATION ACCIDENTS; RYE; WHEAT

5865 (INIS-mf--11562, pp. 5-6) **^{90}Sr levels in milk from the Prague-Radlice Dairy before and after the Chernobyl radiation accident.** Brezik, Z. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni); Beckova, V.; Pickova, L.; Peskova, V. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118--: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. MILK/contamination; STRONTIUM 90/radioecological concentration; CHERNOBYLSK-4 REACTOR; MILK; CONTAMINATION; RADIATION ACCIDENTS; RADIATION MONITORING

5866 (INIS-mf--11562, pp. 7) **^{90}Sr in milk from four localities in the Czech Socialist Republic monitored following the Chernobyl radiation accident.** Brezik, Z. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni); Beckova, V.; Pickova, L.; Peskova, V. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118--: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. MILK/contamination; STRONTIUM 90/radioecological concentration; CHERNOBYLSK-4 REACTOR; MILK; CONTAMINATION; RADIATION ACCIDENTS; RADIATION MONITORING

5867 (INIS-mf--11562, pp. 9) **^{90}Sr and ^{137}Cs contents in flour mill products from cereals harvested in 1986.** Brezik, Z. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni); Kliment, V.; Beckova, V.; Pickova, L.; Metzner, J. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118--: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. CESIUM 137/radioecological concentration; FLOUR/contamination; STRONTIUM 90/radioecological concentration; CHERNOBYLSK-4 REACTOR; FLOUR; CONTAMINATION; RADIATION ACCIDENTS; RADIATION MONITORING

5868 (INIS-mf--11562, pp. 14) **Milk contamination with artificial radionuclides following the Chernobyl accident.** Drabova, D. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni); Rulik, P.; Malatova, I.; Bucina, I.; Hoelgye, Z. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118--: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. MILK/contamination; CESIUM 134; CESIUM 137; CHERNOBYLSK-4 REACTOR; IODINE 131; MILK; CONTAMINATION; RADIATION ACCIDENTS; RADIATION MONITORING

5869 (INIS-mf--11562, pp. 83) **Study of ^{131}I retention in bee products.** Tomasek, M. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni); Wilhelmova, L.; Rybacek, K.; Dvorak, Z.; Tintera, D. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118--: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. HONEY/contamination; IODINE 131/radioecological concentration; POLLEN/contamination; CESIUM 134; CESIUM 137; CHERNOBYLSK-4 REACTOR; HONEY; CONTAMINATION; POLLEN; RADIATION ACCIDENTS

5870 (INP--1310/AP) **Preparation of rock samples for measurement of the thermal neutron macroscopic absorption cross-section.** Czubek, J.A.; Burda, J.; Drozdowicz, K.; Igielski, A.; Kowalik, W.; Krynicka-Drozdowicz, E.; Woznicka, U. Institute of Nuclear Physics, Cracow (Poland). Mar 1986. 61p. (In Polish). Order

Number DE90610785. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Preparation of rock samples for the measurement of the thermal neutron macroscopic absorption cross-section in small cylindrical two-region systems by a pulsed technique is presented. Requirements which should be fulfilled during the preparation of the samples due to physical assumptions of the method are given. A cylindrical vessel is filled with crushed rock and saturated with a medium strongly absorbing thermal neutrons. Water solutions of boric acid of well-known macroscopic absorption cross-section are used. Mass contributions of the components in the sample are specified. This is necessary for the calculation of the thermal neutron macroscopic absorption cross-section of the rock matrix. The conditions necessary for assuring the required accuracy of the measurement are given and the detailed procedure of preparation of the rock sample is described. (author).

5871 (INP–1320/AP) **Methodology of preparation of rock samples for measurement of the thermal neutron macroscopic absorption cross-section.** Czubek, J.A.; Drozdowicz, K.; Igielski, A.; Krynicka-Drozdowicz, E.; Woznicka, U. Institute of Nuclear Physics, Cracow (Poland). 1986. 44p. Order Number DE90610786. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The preparation of the sample consists in filling the measuring container with the crushed and dried rock matrix and in saturating it with a highly absorbing fluid. The geometric dimensions of the sample, the mass contributions of the components of the entire sample and the absorption cross-section of the saturating solution must be well known in order to determine the absorption cross-section of the rock matrix. The determination of the optimum grain size of the rock matrix is important for achieving the highest compaction of the rock in the measuring container. Accuracy of weighing of all components of the sample, determination of the concentration of the saturating solution, saturation of the sample under the vacuum conditions should be taken into account for estimation of the precision of final results of the measurement. (author).

5872 (INP–1325/AP) **Report to the International Atomic Energy Agency: Agency Research Contract no 4121/RB.** Woznicka, U. Institute of Nuclear Physics, Cracow (Poland). Jul 1986. 37p. Contract 4121/RB. Order Number DE90610787. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The results of research done under the International Atomic Energy Agency Contract no 4121/RB: 'Measurement of the thermal neutron macroscopic absorption cross-section on small samples' at the Institut of Nuclear Physics during the period from July 1, 1985 to June 30, 1986 are presented. The research was based on the Plexiglass thermal neutron diffusion parameters and on the method of preparation of the rock samples for the measurements according to the INP method. Three rock samples delivered by the IAEA: Ottawa Sand, Royer Dolomite and Dunite Sand have been measured. (author).

5873 (INP–1330/B) **Report from the results of measurements of radioactive contaminations after Chernobyl accident.** Broda, R.; Grebosz, J.; Wrzesinski, J. Institute of Nuclear Physics, Cracow (Poland). 1986. 14p. (In Polish). Order Number DE90610783. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The results of measurements of radioactive contamination carried out in Cracow during the first days after Chernobyl accident are presented. The particular radioisotopes were determined by gamma spectroscopy. In the period from April 28th to morning hours of May 1st 1986 radiation measurements concerned above all air. After rains considerable contamination of earth's surface was detected and measurements were concentrated on soil contamination. There were also examined water and food samples. The concentration of strontium radioisotopes was determined too. (M. F. W.).

5874 (ORNL/RASA–88/37) **Results of the radiological survey at 146 W. Central Avenue, Maywood, New Jersey (MJ034).** Foley, R.D.; Carrier, R.F. Oak Ridge National Lab., TN (USA). Nov 1989. 17p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90003519. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and reining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid-1950s. Area residents used the sandlike waste from this thorium extraction process mixed with tea and cocoa leaves as mulch in their yards. Some of these contaminated wastes were also eroded from the site into Lodi Brook. At the request of the US Department of Energy (DOE), a group from OaK Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{232}Th, derived from the MCW site. These surveys typically include direct measurement of gamma radiation levels and soil sampling for radionuclide analyses. The survey of this site, a private property at 146 West Central Avenue, Maywood, New Jersey (MJ034), was conducted during 1987 and 1988. While some measurements at this property were greater than background levels typically encountered in the New jersey area, no radiation levels nor radionuclide concentrations exceeded the guidelines established by the DOE for the Maywood, New Jersey, area remedial action plan. However, because of the proximity of the railroad property, which will be remediated, and the DOE's ALARA (As Low As Reasonably Achievable) policy, concurrent removal of the slightly elevated soil layers at 146 W. Central Avenue may be justified. 6 refs., 6 figs., 3 tabs.

5875 (ORNL/RASA–88/43) **Results of the radiological survey at 1 Branca Court, Lodi, New Jersey (LJ034).** Foley, R.D.; Floyd, L.M.; Carrier, R.F. Oak Ridge National Lab., TN (USA). Oct 1989. 11p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90003475. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid-1950s. Area residents used the sandlike waste from this thorium extraction process mixed with tea and cocoa leaves as mulch in their yards. Some of these contaminated wastes were also eroded from the site into Lodi Brook. At the request of the US Department of Energy (DOE), a group from Oak Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{232}Th, derived from the MCW site. The survey typically includes direct measurement of gamma radiation levels and soil sampling for radionuclide analyses. The survey of this site, 1 Branca Court, Lodi, New Jersey (LJ034), was conducted during 1985 and 1986. Results of the survey demonstrated no radionuclide concentrations in excess of the DOE Formerly Utilized Sites Remedial Action program criteria. The radionuclide distributions were not significantly different from normal background levels in the northern New Jersey area. 4 refs., 4 figs., 3 tabs.

5876 (ORNL/RASA–88/90) **Results of the radiological survey at 130 West Central Avenue, Maywood, New Jersey (MJ029).** Foley, R.D.; Floyd, L.M.; Carrier, R.F. Oak Ridge National Lab., TN (USA). Oct 1989. 15p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90003474. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid-1950s. Area residents used the sandlike waste from this thorium extraction process mixed with tea and cocoa leaves as mulch in their yards. Some of these contaminated wastes were also eroded from the site into Lodi Brook. At the request of the US Department of Energy

(DOE), a group from Oak Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{232}Th, derived from the MCW site. The survey typically includes direct measurement of gamma radiation levels and soil sampling for radionuclides analyses. The survey of this site, 130 West Central Avenue, Maywood, New Jersey (MJ029), was conducted during 1987 and 1988. Some radionuclide measurements were greater than typical background levels in the northern New Jersey area. However, results of the survey demonstrated no radionuclide concentrations in excess of the DOE Formerly Utilized Sites Remedial Action program criteria. 4 refs., 7 figs., 3 tabs.

5877 (ORNL/RASA–89/28) **Results of the radiological survey at 90 Orchard Place Maywood, New Jersey (MJ023).** Foley, R.D.; Carrier, R.F. Oak Ridge National Lab., TN (USA). Oct 1989. 9p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OR21400. Order Number DE90003430. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Maywood Chemical Works (MCW) of Maywood, New Jersey, generated process wastes and residues associated with the production and refining of thorium and thorium compounds from monazite ores from 1916 to 1956. MCW supplied rare earth metals and thorium compounds to the Atomic Energy Commission and various other government agencies from the late 1940s to the mid-1950s. Area residents used the sandlike waste from this thorium extraction process mixed with tea and cocoa leaves as mulch in their yards. Some of these contaminated wastes were also eroded from the site into Lodi Brook. At the request of the US Department of Energy (DOE), a group from Oak Ridge National Laboratory conducts investigative radiological surveys of properties in the vicinity of MCW to determine whether a property is contaminated with radioactive residues, principally ^{233}Th, derived from the MCW site. The surveys typically includes direct measurement of gamma radiation levels and soil sampling for radionuclide analyses. The survey of this site, 90 Orchard Place, Maywood, New Jersey (MJ023), was conducted during 1987. While some radiological measurements taken at 90 Orchard Place were slightly greater than typical background levels encountered in the northern New Jersey area, no radionuclide concentrations nor radiation levels exceeded the applicable federal criteria. Based on the survey data it is recommended that this site be eliminated from consideration for inclusion in the DOE remedial action program. 5 refs., 2 figs., 3 tabs.

5878 (PB–89-224083/XAB) **Waste-audit study: Automotive repairs. Final report.** Toy, W.M. Toy (Wesley M.), Saratoga, CA (USA). May 1987. 162p. Available from NTIS, PC A08/MF A01.

See also PB–89-224075.

This document reports on a waste audit study which investigated and analyzed the automotive-repair industry in California. It assessed current waste-management practices and developed specific on-site and off-site waste-treatment recycling alternatives. The conclusions identify and address illegal disposal practices. Recommendations include the segregation of specific wastes for proper disposal and economic analysis of on-site waste-recycling equipment.

5879 (RISO-R–563) **Environmental radioactivity in Denmark in 1987.** Aarkrog, A. (Risoe National Lab. (Denmark)); Boetter-Jensen, L.; Chen Qing Jiang; Dahlgaard, H.; Hansen, H.; Lauridsen, B.; Nielsen, S.P.; Soegaard-Hansen, J.; Holm, E. Risoe National Lab., Roskilde (Denmark). May 1989. 142p. Order Number DE90610852. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

Strontium-90, radiocesium, and other radionuclides were determined in samples from all over the country of air, precipitation, stream water, lake water, ground water, drinking water, sea water, soil, sediments, dried milk, fresh milk, meat, fish, cheese, eggs, grain, bread, potatoes, vegetables, fruit, grass, moss, lichen, sea plants, total diet, and humans. Estimates are given of the mean contents of radiostrontium and radiocesium in the human diet in Denmark during 1987. Tritium was determined in precipitation, ground water, other fresh waters, and sea water. The gamma-spectroscopy at locations around Risoe, at ten of the State experimental farms, along the coasts of the Great Belt and around Gylling Naes. The marine environments at Barsebaeck and Ringhals were monitored for 137Cs and corrosion products (58Co, 60Co, 65Zn, 54Mn). The expanded programme initiated after the Cernobyl accident in 1986 was carried on in 1987 with minor reductions. (author) 159 tabs., 58 ills., 38 refs.

5880 (SSC/TLB–S52-2-183) **Vocabulary of the transportation of dangerous goods.** Jacob, H. Mongrain, J.-P. Department of the Secretary of State of Canada, Montreal, PQ (Canada). Terminology and Linguistic Services Branch. 1988. 497p. (MICROLOG–89-02396). Available from PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This glossary of English-French, French-English terms in the transportation of dangerous goods is based on the terminology used in the Environment Canada EnviroTIPS collection of manuals, supplemented by other bilingual works dealing with regulation, submitted terms from a phone-in service, and the comments of experts in the field. The EnviroTIPS manuals cover physical and chemical properties of dangerous goods; production, transportation and commerce; material handling; compatibility of materials; contaminant spills and movement; environmental protection; laboratory animals; health protection; safety and countermeasures; and contaminant analysis and levels. 136 tabs.

5881 (UCRL–21172) **Site safety plan for Site 300 environmental restoration.** Lawrence Livermore National Lab., CA (USA). Oct 1989. 249p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90003624. Available from NTIS, PC A11/MF A01 - OSTI.

Various Department of Energy Orders incorporate by reference health and safety regulations promulgated by the Occupational Safety and Health Administration (OSHA). One of the OSHA regulations requires that site-specific safety plans are written for activities such as those covered by work plans for Site 300 environmental investigations. Based upon available data, this Site Safety Plan (Plan) for environmental restoration has been prepared specifically for the Lawrence Livermore National Laboratory (LLNL) Site 300 located approximately 15 miles east of Livermore, California. As additional facts, monitoring data, or analytical data on hazards are provided, this Plan may need to be modified. It is the responsibility of the Environmental Restoration Safety Officer (ERSO), with the assistance of Hazards Control to evaluate data which may impact health and safety during these activities and to modify the Plan as appropriate. It should not be viewed that this Plan is "cast-in-concrete." The ERSO shall have the authority, with the concurrence of Hazards Control to institute any change to maintain health and safety protection for workers at the LLNL site. 30 refs.

5882 (WHC-SA–0779) **Hazardous Materials Management and Emergency Response (HAMMER) Training Center feasibility study: Summary report.** Curry, R. Westinghouse Hanford Co., Richland, WA (USA). Nov 1989. 8p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-87RL10930. Order Number DE90003358. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report presents the results of a feasibility study for location of a Hazardous Materials Management and Emergency Response Training Center at Hanford. Westinghouse Hanford Company conducted the study at the request of the US Department of Energy-Richland Operations Office. The study resulted from an initiative by Tri-Cities, Washington area municipal and county entities proposing such a training center. The initiative responded to changes in federal law requiring extensive and specific personnel training for response to incidents involving hazardous materials. Washington Congressman Sid Morrison requested the Department of Energy-Richland Operations Office to evaluate the initiative as a potential business opportunity for the Department of Energy's Hanford Site. 8 refs., 6 figs., 1 tab.

5883 (WSRC-RP–89-59-1-Vol.1) **Savannah River Site environmental report for 1988: Volume 1, Text.** Cummins, C.L.; Hetrick, C.S.; Stevenson, D.A. (eds.); Davis, H.A.; Martin, D.K.; Todd, J.L. Westinghouse Savannah River Co., Aiken, SC (USA).

[1989]. 272p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. Order Number DE90003193. Available from NTIS, PC A13/MF A01 - GPO - OSTI; GPO Dep.

During 1988, as in previous years, Savannah River Site operations had no adverse impact on the general public or the environment. Based on the SRS site-specific code, the maximum radiation dose commitment to a hypothetical individual at the SRS boundary from 1988 SRS atmospheric releases of radioactive materials was 0.46 millirem (mrem) [0.0046 millisievert (mSv)]. To obtain the maximum dose, an individual would have had to reside on the SRS boundary at the location of highest dose for 24 hours per day, 365 days per year, consume a maximum amount of foliage and meat which originated from the general vicinity of the plant boundary, and drink a maximum amount of milk from cows grazing at the plant boundary. The average radiation dose commitment from atmospheric releases to the hypothetical individual on the SRS boundary in 1988 was 0.18 mrem (0. 0018 mSv). This person, unlike the maximumly exposed individual, consumes an average amount of foliage, meat, and milk which originated from the foliage and animals living at the plant boundary.

5884 (WSRC-RP–89-59-1-Vol.2) **Savannah River Site environmental report for 1988: Volume 2, Figures and data tables.** Cummins, C.L.; Hetrick, C.S.; Stevenson, D.A. (eds.); Davis, H.A.; Martin, D.K.; Todd, J.L. Westinghouse Savannah River Co., Aiken, SC (USA). [1989]. 645p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. Order Number DE90003194. Available from NTIS, PC A99/MF A01 - GPO - OSTI; GPO Dep.

This volume of Savannah River Site Environmental report for 1988 (WSRC-RP-89-59-1) contains the figures and tables referenced in Volume 1. The figures contain graphic illustrations of sample locations and/or data. The tables contain summaries of the following types of data: Federal and State standards and guides applicable to SRS operations; concentrations of radioactivity in environmental media; the quantity of radioactivity released to the environment from SRS operations; offsite radiation dose commitments from SRS operations; measurements of physical properties, chemicals, and metals concentrations in environmental media; and interlaboratory comparison of analytical results.

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Refer also to citation(s) 4599, 4611, 4613, 4699, 4700, 4794, 4800, 4801, 4847, 4873, 4874, 4923, 5158, 5193, 5233, 5813, 5847, 5848, 5850, 5882, 5883, 5884, 6189

5885 (BR–85(7.22)) **The ecology of the Sacramento-San Joaquin Delta: A community profile.** Herbold, B. (California Univ., Davis, CA (USA). Dept. of Wildlife and Fisheries Biology); Moyle, P.B. Fish and Wildlife Service, Washington, DC (USA); California Univ., Davis, CA (USA). Dept. of Wildlife and Fisheries Biology. Sep 1989. 106p. Sponsored by U.S. Department of the Interior. Order Number DE90003524. Available from NTIS, PC A06/MF A01; OSTI; U.S. Fish annd Wildlife Service Publications Unit, 18th and C Streets, N.W., Mail Stop 1111, Arlington Square Bldg., Washington, DC 20240.

This report describes an ecosystem significantly different from other delta ecosystems in North America. The Sacramento-San Joaquin Delta is one of the 60 largest river deltas in the world and is the largest river delta on the west coast. As the hub of California's water system, the delta is of immense municipal, agricultural, and industrial importance. The amount of freshwater that flows through the delta controls the delta's productivity and regulates the life cycles of many of its organisms. The vast estuary of the Sacramento and San Joaquin Rivers is one of the most highly modified and intensively managed estuaries in the world. Biological processes in the delta are obscured by the temporal dynamics of the system. Many of the most significant alterations, such as leveeing, diking, and agricultural practices, are not now recognized as such by most citizens, making conservation and protection of the delta difficult. 308 refs., 43 figs., 11 tabs.

5886 (BR–85(7.25)) **The ecology of the seagrass meadows of the west coast of Florida: A community profile.** Zieman, J.C. (Virginia Univ., Charlottesville, VA (USA). Dept. of Environmental Sciences); Zieman, R.T. Fish and Wildlife Service, Washington, DC (USA); Virginia Univ., Charlottesville, VA (USA). Dept. of Environmental Sciences. Sep 1989. 155p. Sponsored by U.S. Department of the Interior. Available from OSTI; U.S. Fish and Wildlife Service, 18th and C Streets, N.W., Mail stop 1111, Arlington Square Building, Washington, DC 20240.

This report summarizes information on the ecology of seagrass meadows on the west coast of Florida, from south of Tampa Bay to Pensacola. This area contains more than 3500 ha of seagrass beds, dominated by three species, Thalasia testudinum (turtle grass), Syringodium filiforme (manatee grass), and Halodule wrightii (shoal grass). Beds occur both on the shallow, zero-energy Continental Shelf and in inshore bays and estuaries. Species ecology, distribution, biomass, and productivity of these dominant seagrass species are discussed. Seagrass beds support a very diverse and abundant algal flora and fauna, and these organisms, and seagrass detritus form the base of a productive food chain. Seagrass beds are important nursery areas providing both cover and food, for a number of commercial and sports fishery species. Along the west Florida coast, estuarine grass beds are noticeably more stressed and impacted by human activities than the more pristine nearshore beds. Urban development and dredging and filling are the major threates to seagrass beds in this region. 500 refs., 28 figs., 14 tabs.

5887 (CEGB-RD/L–3396/R88) **On the structure of the inshore fish community of England and Wales.** Henderson, P.A. Central Electricity Research Labs., Leatherhead (UK). Dec 1988. 27p. Order Number DE90609915. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Records of fish captures on power station intake screens were used to analyse the structure of the English and Welsh inshore fish community. The study was undertaken as part of a programme to predict fish captures at future power station sites. It was found that 118 of the 122 fish species known to live inshore were recorded from the screens of only 12 coastal power stations. The minimum number of species at one site was about 80, found at fully marine localities along the English Channel coast. This number declined with increasing latitude and decreasing salinity. On average, 28 species were present simultaneously and these would include four pelagic, eight demersal and 16 benthic species. There was found to be 31 dominant species which comprised greater than 96% of the total catch by weight or number at all of the sites. These can be considered as the key species through which most of the energy and nutrients in the ecosystem must travel. The major factors determining the abundance of these species were salinity, degree of shelter, summer temperatures and winter temperatures. (author).

5888 (CONF-8906245–1) **Constraints on health risk assessment in the developing world: A case study in Thailand.** Fingleton, D.J. (Argonne National Lab., IL (USA)); Liengcharensit, W.; Smith, K.R.; Edgerton, S. Argonne National Lab., IL (USA). [1989]. 15p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract W-31109-ENG-38. From Air Pollution Control Association (APCS) meeting; Los Angeles, CA (USA); 23-30 Jun 1989. Order Number DE90002169. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Rapid industrialization in the developing countries of the Pacific Basin has been accompanied by a dramatic increase in the formulation, use, and disposal of hazardous materials and residuals. Although there are no comprehensive set of data it is estimated that more than 270 million metric tons of hazardous wastes are generated each year in this region. The disposal of hazardous waste has become a serious problem for many cities in the developing world and great concern is being expressed about the management and disposal of these materials. The capacity to properly dispose of these materials is generally inadequate and the need to provide more capacity is growing. The choice of the best practicable methodology depends on many factors, including technical availability, waste characteristics, desired safety factors, and cost. In addition, many of the high-technology solutions may be inappropriate for developing countries because of high capital costs and the difficulty in maintaining complex industrial plants. Notwithstanding the immediate need for additional capacity, siting of hazardous waste management facilities in all regions of the world has become

an increasingly difficult task. Although much of the scientific community believes the technology exists to site safe and cost-effective facilities, public apprehension often overrides the technical decision. In the United States and Europe there are numerous examples of well-planned facilities failing to be sited because of public opposition. The siting problem has become as much a socio-political issue as a technical issue. Thus, successful siting must be based on an adequate resolution of science and technology questions as well as the sociological considerations related to winning public acceptance. 11 refs., 2 figs., 4 tabs.

5889 (CPS–EPS4SPI) **Response techniques for the cleanup of sinking hazardous materials.** Bonham, N. Environment Canada, Ottawa, ON (Canada). Conservation and Protection. 1989. 155p. (MICROLOG–89-03643). Available from PC Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, CAN K1A 0H3; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

Chemicals denser than water and having a low solubility are very difficult to deal with if accidentally spilled into water bodies. Chemicals in this category include aromatic organics, halogenated hydrocarbons, some organometallic compounds and the elements bromine and mercury. Having a tendency to fall to or flow near the river bottom, the sinkers may permeate the sediments if they are in a liquid form. They can produce chronic toxic effects in aquatic flora and fauna. Difficulties are associated with their detection and cleanup. The possible courses of action when dealing with this type of contamination are: leave it there, remove it for treatment, recover and dispose of it, or use in-situ physical/chemical treatment and/or isolation. These options and various techniques, and their limitations and costs, are examined in this report. Some of the techniques covered include dredging; dykes, trenches, diversion systems, and containment barriers; covering, sealing, solidification, and cementation; sorption, gelation, filtration, gravity separation, sedimentation, and centrifugation; neutralization, precipitation, flocculation, solvent extraction, polymerization, and biological treatment. Data sheets are included for some physical treatment processes and mobile physiochemical treatment units. 54 refs., 29 figs., 34 tabs.

5890 (DOE-RW–88.102) **Development of portable equipment to study physical and chemical phases in natural waters.** Breward, N. (British Geological Survey, London (UK). Geochemistry Div.); Peachey, D. Department of the Environment, London (UK). Aug 1988. 15p. Order Number DE90609820. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A direct and relatively non-invasive method of measuring the speciation of dissolved metals in groundwaters has been developed. The equipment relies on a series of columns containing DAEA cellulose, cation exchange resin and anion exchange resin to extract sequentially and respectively colloids, cationic and anionic species. Organic colloids are eluted from the DAEA cellulose with dilute caustic soda while the inorganic colloids (Fe/Al oxyhydroxide phase) are stripped with dilute mineral acid. A further advantage of this scheme is the ability to concentrate the phases by at least a factor of ten. Applications to the groundwaters of the natural analogue sites currently under study by BGS will offer a means of validating thermodynamic databases used in modelling speciation of radionuclides such as uranium and thorium. (author).

5891 (DOE-RW–88.104) **Transport mechanisms and rates for the long-lived Chernobyl deposits.** Hilton, J. (Freshwater Biological Association, Ambleside (UK)); Davison, W.; Livens, F.; Kelly, M.; Hamilton-Taylor, J. Department of the Environment, London (UK). Sep 1988. 80p. Order Number DE90609821. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

A programme of work has been carried out to determine the various transport rates and mechanisms of Chernobyl radionuclides moving from catchment areas to rivers, reservoirs, lakes and sediments. In so doing the potential for Cs to be retained by and remobilised from sediments was assessed, along with the amount of deposited radioactivity which was in soluble form and hence was available in drinking water. Only a limited Ru-103 data set was obtained before it had decayed away below detection limits. However, results from this period showed that Ru mirrored Cs in its behaviour as it was measurable in the sediments at the same time after the deposition and it was trapped in the bottom waters of the lake. A substantial Cs data set was obtained for two lakes, Windermere and Esthwaite Water and it could be interpreted, with the aid of mathematical models developed during this study, to indicate the major processes and pathways operating in the transport of Cs through lake catchments. During the initial period after the deposition a maximum of 27% of the Cs in the water column was found in the particulate form and rapidly (months) reduced to 10-15% of the total. Total water column concentrations had reduced to half their initial measured values within 15 days in Esthwaite Water and 70 days in Windermere. Cs-134 was observed in surface sediments within 7 days in Esthwaite Water (15.5 m deep) and 30 days in Windermere (65 m deep) which, from a knowledge of mixing regimes of the lakes can be interpreted in terms of similar settlement velocities of 1-2 m per day. A small proportion of Chernobyl material was rapidly moved into the sediment as shown by small concentrations of Cs-134 being found at a depth of 8 cm after one year. This indicates that a non-diffusional transport mechanism, such as bioturbation, may be important for the transport of particulate caesium in sediments. (author).

5892 (EC/IWD–156) **Long range transport of airborne pollutants (LRTAP) aquatic effects monitoring.** Brooksbank, P. (Inland Waters Directorate, Ottawa, ON (Canada)); Haemmerli, J.; Howell, G.; Johnson, L. Environment Canada, Ottawa, ON (Canada). Inland Waters Directorate; Environment Canada, Quebec, PQ (Canada). Inland Waters Directorate; Environment Canada, Moncton, NB (Canada). Inland Waters Directorate; Environment Canada, Saskatoon, SK (Canada). National Hydrology Research Inst. 1989. 51p. (MICROLOG–89-03645). Available from PC Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, CAN K1A 0H3; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This report describes the aquatic effects monitoring network of the Long Range Transport of Airborne Pollutants (LRTAP) Program, as well as the implementation of the network in the Atlantic and Quebec regions. The aim of this network is the integration of federal and provincial LRTAP aquatic monitoring activities into a comprehensive national water quality monitoring network, designed specifically to obtain water quality data and information for the LRTAP program by effective and efficient use of resources. Such a network will provide a high quality compatible database from which assessments of the status of Canada's lakes, rivers, and groundwater resources can be developed with respect to acid deposition. The LRTAP aquatic effects monitoring is a long-term project (i.e., more than 5 years). As the hydrology, chemistry, and biology of surface water systems are highly variable both from year to year and within any given year, a trend can only be established when several years of information has accumulated. Some factors that can influence the variability of the water quality parameters of interest to the acid rain program are emission levels of acid rain precursors (SO_x, NO_x), transport and deposition levels (i.e., weather pattern changes from year to year, precipitation amounts and intensity), basin effects, productivity, natural cycles, land use changes, and changes in economic activity in the region. The design and implementation described in this report will ensure that data collected by the different agencies involved are comparable. More detailed descriptions of the individual monitoring projects and protocols are included as appendices. 55 refs., 3 figs., 15 tabs.

5893 (ENEA-RT-PAS–88-29) **Radionuclides behaviour in the Po River ecosystem (Italy) after the Chernobyl accident.** Quierazza, G.; Guzzi, L.; Cigna, A.A. Ente Nazionale per l'Energia Elettrica, Milan (Italy). Centro Termica e Nucleare; Comitato Nazionale per l'Energia Nucleare, Saluggia (Italy). Mar 1989. 12p. Order Number DE90724692. Available from NTIS (US Sales Only), PC A03/MF A01.

The Chernobyl accident gave the opportunity to carry out a radioecological experiment in a real situation concerning many compartments of the complex ecosystem of the Po Basin. Concentrations of radionuclides in wet and dry deposition, their accumulation in soil, their concentrations in the Po River water and in the biotic riverine components, were determined. A temporal pattern

for wet and dry deposition and the Po water was developed. The investigations on the abiotic river components of ecological significance evidenced the primary role of the organic mineral debris of recent origin as an indicator of the presence of many radionuclides. The radiometric sediments analysis allowed the verification of both the contamination dynamics of the different radionuclides and the influence of the littoral current to determine their distribution. The availability of information on Po River radionuclide concentrations, the rate of ground deposition and on the average and cumulative activity, permitted both the formulation of a circulation model for individual radionuclides in the Po Vallay and of an estimate of the time required to return to the conditions pre-existing at the time of the accident. In particular, it was observed that most of the radioactivity is retained by soil in relation to the different characteristics of each radionuclide and of the constituents of the soil (clay, organic matter, etc.).

5894 (EPRI-EN–6469) **Precision of the EPA seven-day Ceriodaphnia dubia survival and reproduction test: Intra- and interlaboratory study: Final report.** DeGraeve, G.M. (Battelle Columbus Div., OH (USA)); Cooney, J.D.; Marsh, B.H.; Pollock, T.L.; Reichenbach, N.G. Electric Power Research Inst., Palo Alto, CA (USA); Battelle Columbus Div., OH (USA). c Nov 1989. 139p. Sponsored by Electric Power Research Institute. Available from Research Reports Center, Box 50490, Palo Alto, CA 94303.

This study evaluated the intra- and interlaboratory variability of the seven-day Ceriodaphnia test using two reference toxicants (sodium chloride and potassium dichromate), two paper-and-pulp effluents, and two utility effluents. Eleven different laboratories, representing academia, private industry, contractors, and state and federal EPAs participated in the study. The reference toxicants were tested twice during two separate test periods and each industrial effluent was tested once. Using EPA's criteria for a successful test, 56 percent of the 116 planned tests were completed as valid tests. Most invalid tests were unacceptable either because they were not initiated or because control survival was <80 percent. Seventy-eight percent of the tests that were initiated were successfully completed. Reproduction NOEC values were generally somewhat lower than those for survival, but had greater variability than survival NOEC values. The interlaboratory variability of the survival (LC_{50} values) and reproduction (IC_{50} values) results, expressed as the coefficient of variation (CV) ranged between 29.8 percent and 30.8 percent and between 28.9 percent and 39.0 percent, respectively. The study demonstrated that about half (56 percent) of the laboratories participating in the study were able to routinely complete the test successfully. Overall, the variability of the seven-day Ceriodaphnia test was similar to the variability observed with other toxicity tests and analytical measurements. 52 refs., 41 tabs.

5895 (IAEA-R–4939-F) **Chemical and isotopic composition of marine organic matter as indicators of its origin. Final report for the period 15 December 1987 - 14 December 1988.** Malej, A. Ljubljana Univ., Piran (Yugoslavia). Marine Biological Station; International Atomic Energy Agency, Vienna (Austria). Jul 1989. 16p. Order Number DE90609822. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The present study was carried out to evaluate the relative importance of marine and terrestrial sources of Particulate Organic Matter (POM) in the Northern Adriatic Sea. Samples of POM were obtained from the water column at 14 stations using Niskin bottles at 4 depths and sediment traps (placed near the sea floor). Additional samples were obtained of likely source organic matter: sewage, river POM, phytoplankton bloom material, zooplankton, jelly-fish and bethic macrophytes. All samples were analyzed for total carbon and nitrogen and the delta C-13/C-12 ratio (by mass spectrometry). Marine and terrestrial sources of POM were clearly distinguished by their isotopic ratios. A linear model was set up to evaluate the relative importance of these sources at each sampling station. Except in the immediate vicinity of river sources, the marine component appears to dominate. 7 refs, 5 figs, 1 tab.

5896 (INIS-mf–11562, pp. 57) **Determination of ^{222}Rn in water by extraction into toluene scintillation solution.** Podracka, E. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni). Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. LIQUID SCINTILLATORS/radon 222; RADON 222/solvent extraction; AQUEOUS SOLUTIONS; BETA SPECTROSCOPY; RADIUM 226; TOLUENE; WATER

5897 (OME/WRB–87-04066-Vol.2) **The in-place pollutants program: A program overview: Volume 1.** Lomas, T.D. (Ontario Ministry of the Environment, Toronto, ON (Canada)); Persaud, D. Ontario Ministry of the Environment, Toronto, ON (Canada). Water Resources Branch. 1987. 11p. (MICROLOG–87-04066). Available from PC Ontario Ministry of the Environment, Public Information Office, 135 St. Clair Ave. West, Toronto, ON, CAN M4V 1P5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A general overview is provided of the In-Place Pollutants Program, which addresses the impact of contaminants in sediment on overlying water quality and aquatic biota with the aim of developing strategies for the management of contaminated sediments in Ontario. The program uses a holistic aproach which assesses the physical, chemical, and biological aspects of sediment contamination. Objectives include development of protocol documents for laboratory and field studies, providing sediment quality guidelines, and investigation of sediment chemistry, fate and transport of sediment, bottom water chemistry, toxicity of contaminated sediment to biota, and bioaccumulation of contaminants from sediment. 4 figs.

5898 (OME/WRB–87-04066-Vol.3) **The in-place pollutants program: Volume 3. Phase 1 studies.** Persaud, D. (Ontario Ministry of the Environment, Toronto, ON (Canada)); Lomas, T.D.; Hayton, A. Ontario Ministry of the Environment, Toronto, ON (Canada). Water Resources Branch. 1987. 105p. (MICROLOG–87-06347). Available from PC Ontario Ministry of the Environment, Public Information Office, 135 St. Clair Ave. West, Toronto, ON, CAN M4V 1P5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This report documents the studies and findings associated with a program addressing contaminant levels in sediments and benthos from 12 locations in Lake Ontario and the Great Lakes interconnecting channels. The main objectives of the study were to determine the following: the spatial distribution of selected sediment contaminants and the factors influencing such distribution; the biological and physico-chemical availability of heavy metals from sediment; and the levels of various contaminants in benthos and the relationship of these levels to those in the sediment that the organisms feed on. Considerable variations in sediment type and chemistry were noted within and among the different locations sampled. The contaminants were associated mainly with fine-grained fractions, especially the organic matter. Among Lake Ontario locations, Windermere Basin in Hamilton Harbor had the most contaminated sediments, with high organic enrichment apparently due mainly to industrial material such as solvent extractables (oils and greases). Among the rivers, St. Marys River was the most contaminated showing high levels of Zn, Pb, Cu, Mn, Fe, Cr and solvent extractables. Two trends in contaminant uptake were noted: pesticides, which were measured at low concentrations in sediments, were elevated in benthic tissue near sewer outfalls; and Hg, polychlorinated biphenyls, Cu, and Zn were accumulated by the benthos from sediments. The uptake of these contaminants is influenced by the organic matter content of sediment, especially the solvent extractables; the highest uptake occured in sediments with low organic matter content. 27 refs., 26 figs., 27 tabs.

5899 (OME/WRB–87-06347-Vol.2) **In-place pollutants programs: Volume 2. Background and theoretical concepts.** Persaud, D. (Ontario Ministry of the Environment, Toronto, ON (Canada)); Lomas, T.D. Ontario Ministry of the Environment,

Toronto, ON (Canada). Water Resources Branch. 1987. 39p. (MICROLOG–87-06347). Available from PC Ontario Ministry of the Environment, Public Information Office, 135 St. Clair Ave. West, Toronto, ON, CAN M4V 1P5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

The Ontario In-Place Pollutants Program has the objectives of determining the potential impacts of contaminants in sediments on overlying water quality and on aquatic biota, and developing strategies for the management of contaminated sediments that will ensure the protection of water quality and water uses. Research under the program includes characterization of sediment type and chemistry in areas of known sediment contamination, determination of the fate of contaminants in sediments, evaluation of sediment toxicity and bioaccumulation of contaminants, and determination of transport mechanisms. This report provides an overview of relevant background information on the sources and properties of metals and organic contaminants, notably polychlorinated biphenyls and other organic chlorine compounds, in the aquatic system and their influence on benthic organisms. Assessment of the availability of such contaminants from sediment is also briefly reviewed. 35 refs.

5900 (PB–89-868103/XAB) **Ground water: isotope tracing. January 1977-July 1989 (Citations from the Selected Water Resources Abstracts data base). Report for January 1977-July 1989.** National Technical Information Service, Springfield, VA (USA). Aug 1989. 77p. Available from NTISPC N01/MF N01.

This bibliography contains citations concerning the utilization of environmental and artificial radioisotopes to analyze flow paths and mixing, and the physical and chemical characteristics of aquifers. Topics include isotope selection criteria, recharge studies, and aquifer-leakage analyses. Considerable attention is given to methods used in site-specific studies. (Contains 115 citations fully indexed and including a title list.)

5901 (PNL-SA–17100) **Anode materials for electrochemical waste destruction.** Molten, P.M. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 13p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-8910299–1: National Educators workshop, Norfolk, VA (USA), 17-19 Oct 1989). Order Number DE90002724. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Electrochemical Oxidation (ECO) offers promise as a low-temperature, atmospheric pressure method for safe destruction of hazardous organic chemical wastes in water. Anode materials tend to suffer severe corrosion in the intensely oxidizing environment of the ECO cell. There is a need for cheaper, more resistant materials. In this experiment, a system is described for testing anode materials, with examples of several common anodes such as stainless steel, graphite, and platinized titanium. The ECO system is simple and safe to operate and the experiment can easily be expanded in scope to study the effects of different solutions, temperatures, and organic materials. 4 refs., 6 figs.

5902 (SRD-R–453) **Remobilisation of radionuclides from marine sediments: implications for collective dose assessments.** Nicholson, S.; MacKenzie, J. UKAEA Safety and Reliability Directorate, Culcheth (UK). Sep 1988. 44p. Available from H.M. Stationery Office, London, price Pound 5.00.

A model of the transfer (in either direction) of radioactivity between seawater and the seabed is described. It was developed, in the first instance, for inclusion in marine collective dose assessment codes. A review of radionuclide-sediment interactions with particular emphasis on the remobilisation process is followed by a description of the seabed model, an investigation of the effect of the model on estimates of collective dose, and a discussion of sedimentation in the Irish Sea in the context of radioactive discharges. The inclusion of the seabed model may lead to marked decreases in the collective dose at short integration times for nuclides with a high affinity for sediments. For discharges of such radionuclides into the Irish Sea, remobilisation may lead to a significant increase in collective dose compared with estimates obtained ignoring this phenomenon; and thirdly, remobilisation appears to have little effect on collective doses integrated to infinite time for discharges from three other locations in the UK. It is also shown that inclusion of the seabed model leads to predictions of a high uptake of plutonium by the seabed for Irish Sea discharges without the need for anomalously high sedimentation rates. (author).

55 BIOMEDICAL SCIENCES, BASIC STUDIES

5502 Biochemistry

Refer also to citation(s) 4910, 5553, 5603

5903 (DOE/ER/14003–1) **Effect of community structure on the kinetics of anaerobic degradation of aromatic compounds: Progress report, March 1989–November 1989.** McInerney, M.J. Oklahoma Univ., Norman, OK (USA). Dept. of Botany and Microbiology. Nov 1989. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-89ER14003. Order Number DE90003666. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The kinetics of benzoate degradation by Syntrophus buswellii grown in coculture with Desulfovibrio strain G-11 was determined. At low benzoate concentrations the rate of degradation deviated from that predicted by a first-order decay process and reached a threshold of 2 to 3 μM benzoate. S. buswellii was adapted to grow with crotonate and experiments are in progress to isolate this bacterium. An anaerobic bacterium was isolated that catalyzed the cleavage of an aryl ether bond of phenoxyacetate and its chlorinated derivatives forming the respective phenol. The anaerobic fatty acid-degrading bacterium, Syntrophomonas wolfei, catalyzed a rapid formate-bicarbonate exchange reaction and slowly degraded formate. Enzymatic studies showed that the levels of hydrogenase in cell-free extracts of S. wolfei grown in pure culture or in coculture with Methanospirillum hungatei contained very high specific activities of hydrogenase. Formate dehydrogenase activity was present, but the activity was 700 to 900-fold less than hydrogenase activity. S. wolfei was adapted to grow with mono and di-unsaturated fatty acids 5 to 6 carbons in length. Analysis of the fermentation products showed that part of the substrate was β-oxidized while remainder was reduced to the corresponding saturated fatty acid. Propionate was produced from a hexadienoate suggesting that another pathway in addition to β-oxidation exists for the degradation of this compound. Labeling studies and analysis of the monomeric composition of poly-β-hydroxyalkanoate in S. wolfei showed that early in growth PHA was made by the incorporation of an intermediate without cleavage of a C-C bond. Later, PHA was made by a pathway in equilibrium with the acetate pool.

5904 (DOE/ER/14047–2) **Expression of the potyvirus genome: The role of proteolytic processing.** Dougherty, W.G.; Parks, T.D.; Smith, H.A.; Lindbo, J.A. Oregon State Univ., Corvallis, OR (USA). Dept. of Microbiology. [1989]. 21p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract FG06-89ER14047. (CONF-8910307–1: International symposium on virus genes and plant pathogenesis, Lexington, KY (USA), 15-17 Oct 1989). Order Number DE90003388. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The genome of tobacco etch virus (TEV) is initially expressed as a single polyprotein which is cleaved by two viral-encoded proteinases. One of these proteinases, a 49kDa protein, is thought to be structurally related to the trypsin family of serine proteinases, but with a catalytic triad composed of histidine, aspartic acid and cysteine residues. The 49kDa proteinase recognizes and extended seven amino acid sequence (P6 thru P'1) at each cleavage site identified on the TEV polyprotein. This cleavage site contains both conserved and nonconserved amino acids positions. Cell-free studies suggest the nonconserved amino acid positions at a cleavage site influence the rate of processing by the 49kDa proteinase. The possibility of differential processing may be a mechanism of gene regulation during a potyviral replication cycle. 53 refs., 4 figs., 1 tab.

5905 (PNL-SA–16838) **Capillary electrophoresis ionization-mass spectrometry and tandem mass spectrometry.** Edmonds, C.G.; Loo, J.A.; Fields, S.M.; Barinaga, C.J.; Udseth, H.R.; Smith, R.D. Pacific Northwest Lab., Richland, WA (USA). Aug 1989. 24p. Sponsored by U.S. DOE Nuclear Energy; U.S. Department of Health and Human Services; National Science Foundation. DOE Contract

AC06-76RL01830. (CONF-8908181–1: 2. international symposium on mass spectrometry in the health and life sciences, San Francisco, CA (USA), 27-31 Aug 1989). Order Number DE90002664. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The combination of capillary electrophoresis, including capillary zone electrophoresis and capillary isotachophoresis, with electrospray ionization mass spectrometry provides a powerful analytical tool for the analysis of proteins and oligopeptides. The electrospray ionization process provides detection limits in the attomole to femtomole range. The multiple charging phenomena observed in the electrospray ionization mass spectra of large biomolecules also has two important advantageous effects. First, the mass range for analysis with conventional quadrupole mass spectrometers is extended by a factor equal to the extent of charging. This provides mass spectrometric resolution and precision of mass measurement equivalent or superior to mass spectrometric methods dedicated to the measurements at high m/z. Secondly, the efficiency of collisionally induced dissociation (for MS/MS) is markedly enhanced. This provides for an important flexibility and advantage in the qualitative investigation of analytes above the range of mass ordinarily accessible for singly charged analyte parent ions. The experimental results are described suggest the possible extension of tandem MS techniques for protein analysis.

5906 **Pulsed-field gel electrophoresis of very large DNA molecules.** Cantor, C.R. (Columbia Univ., New York, NY (US)); Smith, C.L.; Mathew, M.K. pp. 585 of Annual review of biophysics and and biophysical chemistry. Engelman, D.M. Annual Reviews Inc., Palo Alto, CA (1988).

It is four years since the first demonstration that alternating electrical field direction dramatically facilitates the fractionation of large DNA molecules by size. There is now a large body of experimental results on various experimental configurations and the experimental parameters critical to high-resolution size separation. Separation of large DNA molecules has been used as a tool for a variety of biological problems. These applications have stimulated wide interest in this new technique. Here, the authors focus is on the technique itself. While the separation behavior of DNA in alternating fields has the potential to provide new insights about the molecular properties of large molecules, these insights will depend on the proper blending of experimental and theoretical approaches. The present understanding of the mechanism of these separations is still incomplete. Therefore they concentrate on those lines of experimental endeavor that are likely to elaborate the physical picture of large DNA separations.

5503 Cytology

5907 (ORNL/FTR–3482) **[Crybiology facilities]: Foreign trip report, October 25–November 7, 1989.** Mazur, P. Oak Ridge National Lab., TN (USA). 15 Nov 1989. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90003380. Available from NTIS, PC A03/MF A01 - OSTI.

Dr. David E. Pegg directs a Medical Cryobiology Group in Cambridge of about 10 people that is supported by the UK Medical Research Council. Every five years MRC units are reviewed by Committees to evaluate progress and proposed research, and to make recommendations to the MRC as to whether the units should continue to receive support and, if so, at what level and with what emphasis. The reviews thus are critical. I was asked to be a member of the subcommittee for this year's review of this Group. This report goes into some detail as to the nature of the review process, as I thought the reader might find the comparison with USA systems of interest. One interesting aspect of the review is that cost/benefit aspects are evaluated. Another is that different fields, as well as quality within a field, are evaluated and prioritized by the Council. A third aspect is that the review process has teeth in that it can and has resulted in the closing of whole and in some cases large units. In my view, Pegg and his group constitute one of the premier groups in cryobiology, their publications productivity has been outstanding, and 12 of the 14 referees who were asked to evaluate their performance gave them very high to outstanding marks. Consequently, I expected that they would pass the Subcommittee's review with flying colors. Unfortunately, this proved not to be the case.

5504 Genetics

Refer also to citation(s) 4565

5506 Medicine

Refer also to citation(s) 5613, 5840, 5907, 6200, 6210

5908 (AIR–64600-9/89-FR) **Use of the critical incident technique to evaluate the impact of MEDLINE: Final report.** Wilson, S.R.; Starr-Schneidkraut, N.; Cooper, M.D. American Institutes for Research, Palo Alto, CA (USA). 30 Sep 1989. 348p. Sponsored by U.S. Department of Health and Human Services. N01-LM-8-3529. Order Number DE90003096. Available from NTIS, PC A15/MF A01; OSTI; INIS.

The NLM has an ongoing responsibility to assess the extent to which its information products and services support the requirements of its users. This enables the Library to craft ever more responsive systems that capitalize on the latest advances in information and computer technology and, when necessary, to modify existing systems whose performance may no longer be optimal or consistent with the functions intended. The importance of this requirement was underscored in the recent report of the Outreach Planning Panel to the NLM Board of regents. A fundamental concern is the need to identify the impact of MEDLINE-derived information–i.e., does the use of MEDLINE "make a difference"? In what ways is it used, and with what effect? In particular, is information retrieved from MEDLINE used successfully by health professionals to support medical decision-making and patient care? Previous efforts to address this question have been limited to the collection of available anecdotal reports. Traditional survey methodology, with pre-defined response categories, while used effectively to determine general areas in which MEDLINE information is used, is not well suited to developing a detailed understanding of user motivation, behavior, and resulting consequences. 8 refs., 6 figs., 2 tab.

5909 (INIS-BR–1692) **Proceedings of the 3. Brazilian Congress of Physicists in Medicine.** Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. 265p. (In Portuguese). (CONF-8908184–: 3. meeting of the Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). Order Number DE90609966. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

Some papers about the development of methods and equipments to be used for radiodiagnosis and radiotherapy.

5910 (INIS-BR–1692, pp. 1-22) **Implementation of a program for stereotactic radiosurgery.** Sibata, C.H. (Cleveland Clinic Foundation, OH (USA). Dept. of Radiation Therapy); Higgins, P.D. Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. (CONF-8908184–: 3. meeting of the Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). In *Proceedings of the 3. Brazilian Congress of Physicists in Medicine*. Order Number DE90705978. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

A implementation radiosurgery in the treatment of brain tumors for a Siemens Meratron 6 MV linac is described. The physical concept underlying this treatment, the necessary hardware and quality assurance programs are discussed. Accurate localization of the tumor is done using a stereotactic frame, and three-dimensional treatment planning capability is necessary for this treatment. (C.G.C.).

5911 (INIS-BR–1692, pp. 23-35) **Radiferous photheses.** Rezende, J.R.V. de (Sao Paulo Univ., SP (Brazil). Faculdade de Odontologia). Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. (In Portuguese). (CONF-8908184–: 3. meeting of the Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). In *Proceedings of the 3. Brazilian Congress of Physicists in Medicine*. Order Number DE90705978. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The utilization of Radiferous Prothese in odontological speciality is described, allowing a more efficient application in external actinotherapy. The classifications of Radiferous Prothese are cited, according to its location and function. The conduct of surgeon - dentist face to the irradiated patient is also mentioned. (C.G.C.).

5912 (INIS-BR–1692, pp. 134-160) **Therapeutical electron beams: specification of beam quality from the energy spectrum in the simulator surface.** Fernandes, R.F. (Hospital das Clinicas, Ribeirao Preto, SP (Brazil). Servico de Radioterapia). Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. (In Portuguese). (CONF-8908184–: 3. meeting of the Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). In *Proceedings of the 3. Brazilian Congress of Physicists in Medicine.* Order Number DE90705978. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The seven different quality parameters for the distribution of deep dose radiation in the central axis for electrons are presented. The deep of maximum absorbed dose, the therapeutic way and the dose gradient are studied. Finally the relations between the energy of intriusec electron beams are presented. (author).

5913 (INIS-BR–1692, pp. 190-200) **Influence of air cavity in larynx treatment with 10 MV fotons beams.** Souza, C.N. de (Pernambuco Univ., Recife (Brazil). Dept. de Energia Nuclear); Khoury, H.J. Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. (In Portuguese). (CONF-8908184–: 3. meeting of the Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). In *Proceedings of the 3. Brazilian Congress of Physicists in Medicine.* Order Number DE90705978. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

Aiming to evaluate the influence of air cavity in larynx treatment with 10 MV fotons beams, some studies were done, using the linear accelerator Mevatron-74 and a ionization chamber of parallel plates in air cavity simulated with perspex phantom. (author).

5914 (INIS-BR–1692, pp. 241-247) **Quality control in radiodiagnosis.** Borras, C. (Organizacao Pan-Americana de Saude, Washington, DC (USA)). Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. (In Spanish). (CONF-8908184–: 3. meeting of the Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). In *Proceedings of the 3. Brazilian Congress of Physicists in Medicine.* Order Number DE90705978. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

Some considerations about the importance of the quality control in radiology are presented. The improvement of the image quality using the lower radiation dose is discussed. (author).

5915 (INIS-BR–1739) **Implantation of a integrated system for microcomputers of data processing in radioimmunoassay.** Lin, L.H.; Borghi, V.C.; Lopes, E.M.L.; Moraes, V.K. Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). [1989]. 1p. (In Portuguese). Order Number DE90608885. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Published in summary form only.

5916 (INIS-mf–11544, pp. 22-31) **Computed functional analysis of ^{99m}Tc EHIDA kinetics in patients.** Blaha, V. (Karlova Univ., Prague (Czechoslovakia)); Cihak, I; Nicek, F; Horak, J. Comision Nacional de Energia Atomica, Buenos Aires (Argentina). 1987. (CONF-8610464–: 5. international symposium on radiopharmacology, Buenos Aires (Argentina), 29-31 Oct 1986). In *Progress in radiopharmacology. Proceeding of the fifth international symposium on radiopharmacology held at Buenos Aires, October 29, 30 and 31, 1986.* Order Number DE90705934. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

It is presented a method of EHIDA (dietyl-imino-acetanilidodiacetic acid) kinetic analysing in patients, particularly the kinetic in the hepatic parenchima. A group of 367 patients with different hepatobiliary or other gastrointestinal deseases, was examined and each studied was quantified either in whole extent or at least partially. The scintigraphy is made with several small modifications of the commonly known methods. The hepatic curve is analysed by a computer programme. The results obtained in the whole group of patients were submitted to a statistical evaluation to obtain general conclusions. (M.E.L.).

5917 (INIS-mf–11544, pp. 41-57) **Radiopharmacology of iminodiacetic acid N-derivatives analysis in biological models and comparison to human beings.** Canellas, C.O. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)); Arguelles, M.G.; Mitta, A.E.A. Comision Nacional de Energia Atomica, Buenos Aires (Argentina). 1987. (CONF-8610464–: 5. international symposium on radiopharmacology, Buenos Aires (Argentina), 29-31 Oct 1986). In *Progress in radiopharmacology. Proceeding og the fifth international symposium on radiopharmacology held at Buenos Aires, October 29, 30 and 31, 1986.* Order Number DE90705934. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

It was studied the influence of chemical structures and molecular weight in the distribution of several iminodiacetic acid N-derivatives and to determine the potential use of these radiopharmaceuticals in humans. The study was performed with the following derivatives: N-(2,6 dimetyphenylcarbamoylmethy) iminodiacetic acid, N(2.6 dietylphenyl-carbamoylmethy) iminodiacetic acid, N-(2,6 diisopropylphenylcarbamoylmethy) iminodiacetic acid and the previously unknown N-derivative N-(2,6 diisopropyl, phenylcarbamoylethyl) iminodiacetic aced. These were sinthesized by a modified procedure by MITTA et al. and controlled by NMR, mass spectrometry, elemental composition and also toxicity pirogens, lethal dose and the chelate's radiochemical dose were determined. Liver gallbladder, intestinal and renal kinetics were studied in mice. In order to evaluate the metabolic pathways of the radiopharmaceuticals, the content of gallbladder and the urine were reinjected. Plasma kinetics and the plasmatic half life was determined by extracorporeal circulation in Wistar rats. For the use in human beings, test were carried out in different branches of nuclear medicine, in normal volunteers and carriers of different pathologic disorders. The patients were divided into four groups: acute and chronic cholecystitis, cirrhosis and jaundice. It was obtained the liver/heart activity ratio and estimated the appearance times of the intrahepatic ducts, gallbladder, duodenum and renal persistence. (M.E.L.).

5918 (INIS-mf–11544, pp. 64-74) **^{131}I Metaiodobenzylguanidine (^{131}I MIBG) kinetics in a carcinoid tumor.** Schiavo, R. (Rome Univ. (Italy)); Concolino, G.; Fazi, F.; Iannantuono, P.; Voti, S. Li; Manzara, A.; Pavoni, P. Comision Nacional de Energia Atomica, Buenos Aires (Argentina). 1987. (CONF-8610464–: 5. international symposium on radiopharmacology, Buenos Aires (Argentina), 29-31 Oct 1986). In *Progress in radiopharmacology. Proceeding of the fifth international symposium on radiopharmacology held at Buenos Aires, October 29, 30 and 31, 1986.* Order Number DE90705934. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The ^{131}I-MIBG kinetics was studied in vivo in patients with carcinoid tumors and liver metastases. Activity curve analysis showed that the maximum uptake of ^{131}I-MIBG in a carcinoid tumor occurred after 48 hours, while its biological half time was of 8 days and a half. Although more data are necessary to understand a significant variation in ^{131}I-MIBG kinetics between the different kinds of APUD neoplasms, it is thought that a dynamic-funtional study allowing the evaluation of the different biological half-time, could be helpful for the selection of these neoplasms, which could be treated with ^{131}I-MIBG. Radiation doses required for the treatment are also estimated. (M.E.L.).

5919 (INIS-mf–11562, pp. 21) **Assessing the benefits and hazards of preventive radiodiagnosis examinations. (Methodology aspects).** Heribanova, A. (Krajska Hygienicka Stanice, Prague (Czechoslovakia)); Sevc, J. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. BIOMEDICAL RADIOGRAPHY/ risk assessment; DOSE EQUIVALENTS; MEDICAL EXAMINATIONS; PREVENTIVE MEDICINE; RADIATION HAZARDS; RADIATION PROTECTION

5920 (INIS-mf–11562, pp. 44) **Factors affecting the dose and image quality in mammography.** Mikusova, M. (Institut pro Dalsi Vzdelavani Lekaru a Farmaceutu, Prague (Czechoslovakia)); Kodl, O.; Vojtisek, O. Ceska Lekarska Spolecnost J.E. Purkyne,

Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. BIOMEDICAL RADIOGRAPHY/ radiation doses; MAMMARY GLANDS/biomedical radiography; DOSE EQUIVALENTS; IMAGE INTENSIFIERS; IMAGES; KERMA

5921 (INIS-mf–11562, pp. 90) **Image analysis in X-ray radiodiagnosis.** Zachariasova, I. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni); Kodl, O. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. BIOMEDICAL RADIOGRAPHY/ images; IMAGES; FAILURES; IMAGE PROCESSING

5922 (INIS-mf–11562, pp. 63) **Results of questionnaire enquiry on activities of radiopharmaceutikals administered to children and adults at nuclear medicine work places in Czechoslovakia.** Rickova, H. (Krajska Hygienicka Stanice, Brno (Czechoslovakia)); Husak, V. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. MEDICAL EXAMINATIONS/ radiopharmaceuticals; RADIOPHARMACEUTICALS/radioactivity; ADULTS; CHILDREN; DOSE EQUIVALENTS; RADIOPHARMACEUTICALS; PATIENTS; RADIATION HAZARDS; RADIOACTIVITY

5923 (MTR–7966) **Task force report on health effects assessment.** Anderson, C.; Hushon, J. Mitre Corp., McLean, VA (USA). METREK Div. Aug 1978. 126p. Sponsored by U.S. DOE Energy Research. DOE Contract AC01-78EV06202. Order Number DE90003528. Available from NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

From April to August, 1978 MITRE supported the Health Effects Assessment Task Force sponsored by the Office of the Assistant Secretary for the Environment at DOE. The findings of that Task Force are incorporated in this report and include a detailed definition of health effects assessment, a survey of the mandates for health effects assessments within DOE/EV, a review of current DOE-EV health effects assessment activities, an analysis of the constraints affecting the health effects assessment process and a discussion of the Task Force recommendations. Included as appendices are summaries of two workshops conducted by the Task Force to determine the state-of-the-art of health effects assessment and modeling and a review of risk assessment activities in other federal agencies. The primary recommendation of the panel was that an office be designated or created under the Office of the Assistant Secretary for the Environment to coordinate the Health Effects Risk Assessment effort covering up to 40 program and policy areas; a similar need was expressed for the environmental effects assessment area. 1 tab.

5924 (NAC–88-14) **Effects of various filters on a p(66 MeV)/Be neutron beam.** Jones, D.T.L. (Faure Hospital (South Africa)); Yudelev, M. National Accelerator Centre, Faure (South Africa). Sep 1988. 9p. (CONF-880833–: World congress on medical physics and biomedical engineering, San Antonio, TX (USA), 6-12 Aug 1988). Available from the National Accelerator Centre, Council for Scientific and Industrial Research, P.O. Box 72, Faure, 7131, South Africa.

Beam filters which may be required for the clinical use of a neutron source are: hardening filters which reduce the RBE differential between surface and depth and increase beam penetration; flattening filters which are shaped to produce more uniform isodose distributions; wedge filters which selectively tilt the isodose distributions; and charged particle filters which may increase skin sparing by absorbing recoil particles from the beam but which have little effect on neutrons. The effects of these filters on dose and dose distribution have been investigated on the National Accelerator Centre's p(66 MeV)/Be(40MeV) neutron therapy beam in order to determine the optimum designs required to meet specifications. 8 figs., 1 tab.

5925 (ORNL/FTR–3484) **[Biological markers for tumors]: Foreign trip report, September 30–November 7, 1989.** Kennel, S.J. Oak Ridge National Lab., TN (USA). [1989]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90003198. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Research was carried out and discussions were held at IRE with A. Sacchi and R. Falcioni. Work was concluded on one manuscript describing the expression of $\alpha^6\beta_4$ in lung tissue and lung tumors. Another manuscript on the expression of $\alpha^6\beta_4$ in normal colon and colon tumors was planned. The traveler performed research concerning the quantitation and molecular structure of $\alpha^6\beta_4$ in human tissues using new monoclonal antibodies developed at ORNL. A manuscript describing these experiments and others is being prepared. A seminar was presented to the Institute.

5926 (PB–89-230742/XAB) **Clarification of radiation-control regulations for diagnostic x-ray equipment.** Food and Drug Administration, Rockville, MD (USA). Center for Devices and Radiological Health. Mar 1989. 114p. (HHS/PUB/FDA–89-8221). Available from NTIS, PC A06/MF A01.

Supersedes PB–84-164946.

The Office of Compliance and Surveillance of the Center for Devices and Radiological Health (CDRH) has received many requests for interpretation of the Federal regulations that relate to diagnostic x-ray equipment. Responses to these requests were originally issued as FDA Compliance Policy Guides, industry-wide letters, and letters to individuals. The document is a compilation of those responses that remain applicable. Guides or opinions that have been withdrawn or are now obsolete because they have been incorporated into the regulations are not included. The document consists of two sections: the General section, which contains information of a general nature; and the Specific section, which contains information specific to particular sections of the Federal Performance Standard for Diagnostic X-ray Equipment (21 CFR 1020.30-32). When the term 'Revised Language' appears in an item heading, it indicates English grammar correction; the term 'Revised' indicates an updated version of the original clarification.

5507 Microbiology

Refer also to citation(s) 4565, 4566, 4567

5509 Pathology

Refer also to citation(s) 5955

5520 Public Health

Refer also to citation(s) 4668, 4669, 4926, 5962

5530 Agriculture and Food Technology

Refer also to citation(s) 5240, 5346, 5873, 6213

5927 (IAEA-R–4580-F) **Bioavailable iron in typical Thai meals: Comparative studies between radioactive in vitro and in vivo food iron absorption measurements. Final report for the period 1 November 1986 - 31 October 1987.** Sritongkul, N. Siriraj Hospital Medical School, Bangkok (Thailand). Section of Nuclear

Medicine; International Atomic Energy Agency, Vienna (Austria). Mar 1989. 20p. Order Number DE90609897. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Presently available in vivo methods for assessing iron absorption in human subjects, although physiologically acceptable and accurate, are not practical for screening large numbers of food and diet samples. A simple in vitro method for determining the amount of iron available for absorption was therefore investigated. It is based on the common pool concept of food iron absorption using radioactive Fe-59 as a marker of the iron present in the bioavailable iron pool. The ionizable iron was measured after an initial peptic digestion by using pepsin/HCl at pH 1.35 followed by an increase of the pH to 6.0 to simulate duodenal alkalinity. The method was proved to be simple, reproducible and applicable either to single food items or whole meals of varying composition. It is able to detect known enhancers or inhibitors of food iron absorption. The percent ionizable iron among 5 different meals with the inclusion of inhibitor or enhancer was shown to correlate closely with the percentage of iron absorbed in human subjects ($r=0.9197$, $p<0.001$). A high correlation between the in vivo and in vitro methods was also observed when the results were expressed as absorption ratios and ionizable ratios ($r=0.9192$, $p<0.001$). The method is expected to be useful for improving diet composition to increase the iron availability of some typical meals in developing countries, including those which are known to contain considerable amounts of inhibitors of iron absorption. 39 refs, 1 fig., 13 tabs.

5928 (INIS-mf–11562, pp. 88) **Derived intervention levels for food contamination with ^{131}I and ^{137}Cs.** Vladar, M. (Vyskumny Ustav Preventivneho Lekarstva, Bratislava (Czechoslovakia)); Tatara, M. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. CESIUM 137/food; FOOD/dose limits; IODINE 131/food; FOOD; CONTAMINATION; RADIATION ACCIDENTS; RADIATION PROTECTION

5929 (NRC–29197) **Proceedings [of the] symposium on the aerial application of pesticides in forestry.** Green, G.W. (ed.) (Canadian Forestry Service). National Research Council of Canada, Ottawa, ON (Canada). Oct 1987. 398p. (CONF-8710504–: Symposium on the aerial application of pesticides in forestry, Ottawa (Canada), 20-22 Oct 1987; MICROLOG–89-03259). Available from PC Canadian Forestry Service, Government of Canada, 351 St. Joseph Boulevard, Hull, PQ, CAN K1A 1G5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

A symposium was held to specifically examine the state of the art of the aerial application of pesticides as it applies to forestry and to identify immediate as well as midterm research needs of the pest management aspects of forestry. Papers were presented on topics including the principles of spray droplet formation, spray cloud measurement and assessment, modelling of spray cloud behavior, operational considerations, field experience in various countries, pest behavior, and measuring methods and instruments used in air spraying applications. A separate abstract has been prepared for one paper from this symposium.

56 BIOMEDICAL SCIENCES, APPLIED STUDIES

5601 Radiation Effects

Refer also to citation(s) 4796, 5925, 6247

5930 (AD-A–211710/9/XAB) **Radiation-induced volatile hydrocarbon production in platelets. Scientific report.** Radha, E.; Vaishnav, Y.N.; Kumar, K.S.; Weiss, J.F. Armed Forces Radiobiology Research Inst., Bethesda, MD (USA). 1989. 8p. (AFRRI-SR–89-22). Available from NTIS, PC A02/MF A01.

Pub. in Life Sciences, Vol. 44, 1185-1191(1989).

Thrombocytopenia plays an important role in the development of the post-irradiation hemorrhagic syndrome. Although destruction of platelet precursors in bone marrow is a major effect of high-dose radiation exposure, the effects of radiation on preformed platelets are unclear. The latter is also of concern with respect to blood-banking practices since platelets are often irradiated at doses in the range of 20-50 Gy before transfusions to prevent graft-versus-host disease. With increasing emphasis on allogenic and autologous bone-marrow transplantation, transfusions of irradiated platelets are likely to rise. Generation of volatile hydrocarbons (ethane, pentane) as a measure of lipid peroxidation was followed in preparations from platelet-rich plasma irradiated in vitro. The hydrocarbons in the headspace of sealed vials containing irradiated and nonirradiated washed platelets, platelet-rich plasma, or platelet-poor plasma increased with time. The major hydrocarbon, pentane, increased linearly and significantly with increasing log radiation dose, suggesting that reactive oxygen species induced by ionizing radiation result in lipid peroxidation. Measurements of lipid peroxidation products may give an indication of suboptimal quality of stored and/or irradiated platelets.

5931 (DOE/ER/60625–1) **Solid state radiation chemistry of the DNA backbone: Progress report, November 15, 1987–July 13, 1989.** Bernhard, W.A. Rochester Univ., NY (USA). Sep 1989. 8p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER60625. Order Number DE90003665. Available from NTIS, PC A02/MF A01; OSTI; INIS.

The long term goal of this program is to determine the fundamental rules needed to predict the type and yield of damage produced in DNA due to direct effects of ionizing radiation. The focus is on damage to the sugar-phosphate backbone, damage that would lead to strand breaks. Model systems have been chosen that permit various aspects of this problem to be investigated. The emphasis will be on single crystals of monosaccharides, nucleosides, and nucleotides but will also include some powder work on polynucleotides. In these model systems, free radical products and reactions are observed by electron spin resonance (ESR) and electron nuclear double resonance (ENDOR) techniques. The information thus gained is used in constructing rules that predict what primary free radicals are formed in single crystals of model compounds and the reactions stemming from the primary radicals. The formulation of a set of rules that work in model systems will represent a major advance toward formulating a set of rules that predict the direct damage in DNA itself. In a broader context this program is part of the effort to understand and predict the effects of exposure to ionizing radiation received at low dose rates over long periods of time. Assessment of low dose effects requires a basic understanding of the action of radiation at the molecular level. By contributing to that basic understanding, this program will help solve the problems of risk assessment under low dose conditions. 5 refs., 3 figs.

5932 (ENEA-RT-PAS–89-12) **Statistical evaluation of internal contamination, due to the Chernobyl accident, in man (Italy).** Tarroni, G.; Battisti, P.; Melandri, C.; Castellani, C.M.; Formignani, M. Comitato Nazionale per l'Energia Nucleare, Bologna (Italy). Jun 1989. 42p. (In Italian). Order Number DE90724684. Available from NTIS (US Sales Only), PC A03/MF A01.

The main implications of general interest derived from the statistical analysis of the internal human contamination data obtained by ENEA-PAS (Italy) with whole body counter measurements performed in Bologna after the Chernobyl accident are presented. In particular, the trend with time of the individual body activity of members of a homogeneous group, the variability of individual contamination in relation to the mean contamination, the statistical distribution of the data, the significance of mean values concerning small, homogeneous group of subjects, the difference between subjects of different sex and its trend with time, are examined. Finally, the substantial independence of the overall individual committed dose equivalent evaluation due to the Chernobyl contamination from the hypothesized values of the metabolic parameters is pointed out

for the case in which the evaluation is performed on the basis of direct measurements with a whole body counter.

5933 (ENEA-RT-PAS–89-14) **Committed dose equivalents based on whole body counting measurements in Italy after Chernobyl.** Melandri, C.; Castellani, C.M.; Battisti, P.; Tarroni, G. Comitato Nazionale per l'Energia Nucleare, Bologna (Italy). Jun 1989. 39p. (In Italian). Order Number DE90724675. Available from NTIS (US Sales Only), PC A03/MF A01.

During normal working activities or in accidental situations, when the introduction of radioactive gamma emitters is of non-negligible amount, accurate determination of effective committed dose equivalents based on direct measurements of internal contamination cannot be avoided. Internal contamination measurements carried out by a whole body counter and the application of dosimetric and metabolic models, as proposed by ICRP Publication 30, allow the intakes and committed dose equivalents to be evaluated. This paper presents the evaluation methodologies of committed dose equivalents both for instantaneous and extended contaminations. Furthermore, some advice about useful, opportune modes and measurement time intervals, in order to minimize uncertainties due to the application of generalized models to particular situations, are also reported. On the basis of the Chernobyl experience, the general criteria for the choice and size of homogeneous groups of individuals to be measured, are submitted to allow the collecting of the necessary radiation protection information concerning contamination of a part or a whole population.

5934 (GSI–89-69(prepr.)) **Influence of radiation quality on heavy ion induced chromosome aberrations in V79 cells.** Ritter, S.; Kraft-Weyrather, W.; Scholz, M.; Kraft, G. Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.). Sep 1989. 6p. Contract CEC B16-0197-D. Available from Available from Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.).

The induction of chromosome aberrations after irradiation of V79 Chinese hamster cells with Ar-ions at energies of 10.5 MeV/u (LET 1100 keV/μm) and 75 MeV/u (LET 250 keV/μm) was studied up to 24 hours after irradiation. For comparison also X-ray experiments were performed. Analysis of data was based on the same level of cell survival (20%). Our data indicate a correlation between the radiation quality determined by track parameters and the induction of chromosome aberrations. 75 MeV/u Ar-ions characterized by a lower ionization density are more effective in the induction of chromosome damage than 10.5 MeV/u Ar-ions. Also, the induction of a special aberration type, i.e. the formation of exchanges, is favoured by the lower ionisation density. Additionally the radiation quality influences the progression of cells through the cell cycle. Immediately after irradiation a mitotic delay can be observed. With increasing ionization density the mitotic delay is more pronounced. The response of cells to particle radiation differs quite largely from those observed after X-ray irradiation. (orig.).

5935 (IC–89/267) **Towards an understanding of CG methylation in DNA transcription.** Chela-Flores, J.; Migoni, R.L. International Centre for Theoretical Physics, Trieste (Italy). Sep 1989. 17p. Order Number DE90610823. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A simple model of DNA is considered in which the nucleotides cytosine (C) and guanine (G) are not assumed to be identical, and in which macroscopic thermodynamic quantities may be calculated exactly. The H bonds between the C and G nucleotides are assumed to be Morse potentials. We discuss the statistical mechanics of the DNA molecule in the configuration (5'...GGG...3'; 3'...CCC...5'), which may be copied by RNA polymerase into a messenger RNA (mRNA) strand (5'...CCC...3'). This model suggests that replacements of C by 5-methylcytosine (5mC) may be a secondary effect in the inhibition of genetic expression, not interfering directly with the formation of an open state. An experimental test is suggested. The implications of this result are discussed for a related system, in which the enzyme methylase is known to methylate almost exclusively those Cs that are followed by Gs as a regulatory strategy employed by some eukaryotes. (author). 14 refs, 2 figs.

5936 (INIS-mf–11562, pp. 16) **Calculation of microdosimetry characteristics of low energy electrons.** Fueloep, M. (Vyskumny Ustav Preventivneho Lekarstva, Bratislava (Czechoslovakia)); Ftacnikova, S.; Cierna, V. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. AUGER EFFECT/biological radiation effects; ANIMAL CELLS; BROMINE 77; DELTA RAYS; DNA; ENERGY LOSSES; IODINE 125; MICRODOSIMETRY

5937 (INIS-mf–11562, pp. 4) **Prenatal lethality of the offspring of mice irradiated with sublethal gamma doses.** Brezani, P. (Univerzita P.J. Safarika, Kosice (Czechoslovakia). Katedra Vseobecnej Biologie); Fedorocko, P. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. LETHAL MUTATIONS/mutation frequency; PRENATAL IRRADIATION/lethal mutations; GAMMA RADIATION; GENETIC RADIATION EFFECTS; GERM CELLS; MICE; SUBLETHAL IRRADIATION

5938 (INIS-mf–11562, pp. 15) **Possible application of cell growth factors on alleviating radiation effects.** Fedorocko, P. (Univerzita P.J. Safarika, Kosice (Czechoslovakia). Katedra Vseobecnej Biologie); Brezani, P. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. LYMPHOKINES/radioprotective substances; BIOLOGICAL RADIATION EFFECTS; GROWTH; LETHAL IRRADIATION; LYMPHOKINES; MICE

5939 (INIS-mf–11562, pp. 70) **Radiosensitivity of older hemopoiesis stem cells.** Svoboda, V. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni); Sedlak, A.; Kofranek, V. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. STEM CELLS/radiosensitivity; BLOOD FORMATION; CFU; MICE; RADIOSENSITIVITY; SURVIVAL CURVES; X RADIATION

5940 (INIS-mf–11562, pp. 64) **Some theoretical approaches to the effect of radiation dose on life expectancy.** Sedlak, A. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni). Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech).

(CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. RADIATION DOSES/life span; SURVIVAL CURVES

5941 (INIS-mf–11562, pp. 40) **Study of internal Cs contamination of Czechoslovak population by urine counting.** Malatova, I. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni); Koublova, I.; Drabova, D. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. CESIUM 134/radionuclide kinetics; CESIUM 137/radionuclide kinetics; FALLOUT; HUMAN POPULATIONS; RETENTION; URINE

5942 (INIS-mf–11562, pp. 41) **Estimate of internal contamination doses in accident involving ^{241}Am.** Malatova, I. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni); Filgas, R.; Koublova, I.; Klener, V. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. AMERICIUM 241/radionuclide kinetics; ACCURACY; AMERICIUM OXIDES; RADIATION ACCIDENTS; RADIATION DOSES

5943 (INIS-mf–11562, pp. 32) **Difference in plutonium retention in mice - strain dependence?.** Kofranek, V. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni); Sedlak, A.; Svoboda, V. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. PLUTONIUM 238/retention; DTPA; FEMUR; MICE; RETENTION; RADIONUCLIDE KINETICS

5944 (INIS-mf–11562, pp. 49) **Transport of selected radionuclides into animal products.** Musatovova, O. (Ustav Radioekologie a Vyuzitia Jadrovej Techniky, Kosice (Czechoslovakia)); Vavrova, M.; Navarcik, I.; Oravec, J.; Wirdzek, S. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. CESIUM 137/food chains; STRONTIUM 90/food chains; CONTAMINATION; FEEDING; MEAT; MILK

5945 (INP–1321/B) **Doses and biological effect of ionizing radiation.** Hrynkiewicz, A. Institute of Nuclear Physics, Cracow (Poland). 1986. 19p. (In Polish). Order Number DE90610830. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Basic values and their symbols as well as units of physical dosimetry are given. The most important information about biological radiation effects is presented. Polish radiation protection standards are cited. (A.S.).

5946 (JINR-R–19-87-215) **Escherichia coli PQ-37 induction of SOS-system by accelerated heavy ions.** Kozubek, S. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems); Krasavin, E.A.; Lin', N.; Amirtaev, K.G.; Tokarova, B.; Bonev, M.; Soshka, I.; Drashil, V. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems. 1987. 8p. (In Russian). Order Number DE90610826. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Data on induction of the SOS-system of E.coli PQ 37 by radiation of various quality are obtained. The degree of induction is measured by chromotest. The induction factor is observed to increase as LET grows to 50 keV/μm. The radiation capability of inducing the SOS-system decreases for LET $\sim$ 50 keV/μm.

5947 (ORNL/FTR–3431) **[Radiation protection guidance]: Foreign trip report, September 30–October 11, 1989.** Richmond, C.R. Oak Ridge National Lab., TN (USA). 16 Nov 1989. 50p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90003202. Available from NTIS, PC A03/MF A01 - OSTI.

The traveler attended the meeting of the International Commission on Radiological Protection (ICRP) and its committees in Oxford, England. This was the first meeting of the Main Commission with all its committees as formed for the 1989–1993 period. The major item of business was to review a draft report that, when finalized, will constitute the revised basic ICRP radiation protection guidance. It is clear that there is much work to be done by ICRP committees and task groups to prepare reports containing information that can be used in conjunction with the revised guidance, e.g., a revised ICRP 30 series of reports. It is extremely important that the US Department of Energy, and other US agencies, including the Commission on Interagency Radiation Research and Policy Coordination (CIRRPC), not repeat the error committed after the previous ICRP general radiation protection guidance was released in 1977 (ICRP Report No. 26). The US had much difficulty in understanding the implications of the recommendations and their impact on federal and other facilities. As a result there was a long delay in US agencies adopting the ICRP 26 terminology and secondary limits. Actually, all DOE contractors were directed this year, via DOE order 5480.11, to comply with what is basically ICRP 26 and 30 by the end of this calendar year. Much of the rest of the world had adopted most or all of the ICRP 26 and 30 guidance years ago. The US position appeared very confused as regards ICRP 26 to the rest of the world.

5948 (WSRC-RP–89-964) **DOE Order 5480.11 implementation in the internal dosimetry program at Savannah River Site.** Morgan, C.R. Westinghouse Savannah River Co., Aiken, SC (USA). [1989]. 2p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC09-89SR18035. (CONF-8911134–2: 35. annual conference on bioassay, analytical and environmental radiochemistry, Charleston, SC (USA), 2 Nov 1989). Order Number DE90003503. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Savannah River Site (SRS) produces and recovers tritium and isotopes of plutonium and uranium to serve our national security interest. SRS also has processed neptunium, curium, and californium. These materials and our radioactive waste products constitute the radioactive materials considered in our internal dosimetry program. All individuals who work in and all visitors who enter radiologically controlled areas at SRS are included in the internal dosimetry radiobioassay program. The radionuclides to be analyzed and the frequency of samples are determined by health protection personnel. This year SRS will process over 100,000 tritium samples, approximately 7500 plutonium samples, and approximately 3000 enriched uranium samples and will perform approximately 15,000 fission product scans and 3000 chest counts. We process our tritium samples by liquid scintillation counting, our plutonium samples by electrodeposition and alpha spectroscopy,

and our remaining samples typically by solvent extraction methods using gross alpha or beta counting.

5949 **Nuclear accident dosimetry intercomparison studies.** Sims, C.S. (Oak Ridge National Lab., TN (USA)). *Health Physics (USA)*, 57(3): 439-448 (Sep 1989).

Twenty-two nuclear accident dosimetry intercomparison studies utilizing the fast-pulse Health Physics Research Reactor at the Oak Ridge National Laboratory have been conducted since 1965. These studies have provided a total of 62 different organizations a forum for discussion of criticality accident dosimetry, an opportunity to test their neutron and gamma-ray dosimetry systems under a variety of simulated criticality accident conditions, and the experience of comparing results with reference dose values as well as with the measured results obtained by others making measurements under identical conditions. Sixty-nine nuclear accidents (27 with unmoderated neutron energy spectra and 42 with eight different shielded spectra) have been simulated in the studies. Neutron doses were in the 0.2-8.5 Gy range and gamma doses in the 0.1-2.0 Gy range. A total of 2,289 dose measurements (1,311 neutron, 978 gamma) were made during the intercomparisons. The primary methods of neutron dosimetry were activation foils, thermoluminescent dosimeters, and blood sodium activation. The main methods of gamma dose measurement were thermoluminescent dosimeters, radiophotoluminescent glass, and film. About 68% of the neutron measurements met the accuracy guidelines (+/- 25%) and about 52% of the gamma measurements met the accuracy criterion (+/- 20%) for accident dosimetry.

5603 Chemicals Metabolism and Toxicology

Refer also to citation(s) 4926

5950 (AD-A-211666/3/XAB) **Inhalation toxicology of red and violet dye mixtures. Phase 1. Engineering report. Report for 15 March 1987-1 November 1988.** Davies, D.W.; Higuchi, M.A. Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab. Jun 1989. 130p. Available from NTIS, PC A07/MF A01.

An inhalation exposure facility was developed at the U.S. Environmental Protection Agency, Research Triangle Park, NC, to conduct inhalation exposures of rodents to dye mixtures used by the U.S. Army in the manufacture of smoke munitions. The exposures were to evaluate the health effects of inhaled dye mixtures on rodents and simulate industrial-type exposures in load, assembly, and pack plants. Workers at the plants can accidently come in contact with the dye, by dermal and/or pulmonary exposures. The facility, laboratory equipment and test procedures are described.

5951 (ORNL/M-947) **TNT metabolites in animal tissues: Quarterly technical progress report, July 1-September 30, 1989.** Shugart, L.R. Oak Ridge National Lab., TN (USA). Oct 1989. 16p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC05-84OR21400. Order Number DE90003199. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The overall objectives of this project are: (1) to provide quantitative analytical procedures for the analysis of TNT and at least eight of its metabolites in animal tissues, and (2) to obtain representative samples of tissues from animals from designated Army sites and to determine the presence or absence of TNT and its metabolites in these samples. The study is divided into two Phases corresponding to the stated overall objectives of the project. 2 figs., 2 tabs.

5952 (PB-89-137772/XAB) **Risk analysis: A guide to principles and methods for analyzing health and environmental risks.** Cohrssen, J.J.; Covello, V.T. Council on Environmental Quality, Washington, DC (USA). 1989. 414p. Available from NTIS, PC E05/MF A01.

The Council on Environmental Quality has prepared the guide as an introduction to risk analysis and as a readily accessible reference manual. Designed for consumers of risk information, the book offers a balance between the technical and nontechnical literature.

5953 (PB-89-235998/XAB) **Molybdenum hazards to fish, wildlife, and invertebrates: A synoptic review.** Eisler, R. Patuxent Wildlife Research Center, Laurel, MD (USA). Aug 1989. 72p. (BIOLOGICAL-85(1.19)). Available from NTIS, PC A04/MF A01.

Ecological and toxicological aspects of molybdenum (Mo) in the environment are briefly reviewed, with emphasis on fish and wildlife. Subtopics include sources and uses, chemical properties, mode of action, background concentrations in biological and nonbiological samples, and lethal and sublethal effects on terrestrial plants and invertebrates, aquatic organisms, birds, and mammals. Current recommendations for Mo and the protection of sensitive living resources are presented.

5954 (PB-89-237176/XAB) **Direct viable counting method for measuring tolerance of aquatic microbial communities to Hg(2+1).** Liebert, C.; Barkay, T. Environmental Protection Agency, Gulf Breeze, FL (USA). Environmental Research Lab. 1988. 8p. (CONTRIB-628). Available from NTIS, PC A02/MF A01.

Pub in the Canadian Jnl. of Microbiology, Vol. 34, 1090-1095(1988).

Direct counts of Hg^{2+}-resistant cells in natural waters were obtained by fluorescence microscopy after incubation for 20 hours in the presence of a growth substrate, nalidixic acid, to halt cell division, and inhibiting concentrations of Hg^{2+}. The method discriminated Hg^{2+} resistant from sensitive Escherichia coli strains. Estuarine samples were used to compare this procedure with two other toxicity measurements that determine the effect of Hg^{2+} on colony growth and on rates of radioactive-thymidine incorporation into cellular material. Toxicity measurements based on direct viable counts and thymidine incorporation rates had comparable sensitivities, and both were 3-4 orders of magnitude more sensitive than the method that utilized colony counts. Thus, the direct enumeration of Hg^{2+} resistant cells is useful for predicting the potential of aquatic communities to sustain heterotrophic activity, an essential microbial process, in the presence of Hg^{2+}.

5955 (PB-89-237465/XAB) **Computational approaches to the identification of suspect toxic molecules.** Politzer, P. New Orleans Univ., LA (USA). Dept. of Chemistry. 1988. 22p. Available from NTIS, PC A03/MF A01.

Pub. in Toxicology Letters, Vol. 43, 257-276(1988).

This report presents computational approaches that can be used for the relatively rapid identification of suspect toxigens, including carcinogens, in two different classes of compounds: halogenated olefins and epoxides, and substituted dibenzo-p-dioxins. A common element in these approaches is the key role played by the molecular electrostatic potential. It is applied in two different ways, however; it is used to assess the reactivity of a specific site in the case of the epoxides, and for the dibenzo-p-dioxins the focus is on the overall pattern of negative regions above the molecular plane. Results obtained so far are encouraging and indicate that these can be regarded as useful screening techniques for identifying compounds that require further and more exhaustive investigation.

5956 (PB-89-873632/XAB) **Toxicity of nickel. February 1970-September 1989 (Citations from the NTIS data base). Report for February 1970-September 1989.** National Technical Information Service, Springfield, VA (USA). Oct 1989. 137p. Available from NTISPC N01/MF N01.

Supersedes PB-88-860283.

This bibliography contains citations concerning the toxicity, carcinogenicity, environmental pollution, and other hazards and adverse effects of nickel. The detection, characterization, analytical methods, standards, and removal from the environment are discussed. These aspects of nickel are dealt with in relation to aquatic and terrestrial flora and fauna, including humans. (This updated bibliography contains 228 citations, 18 of which are new entries to the previous edition.)

5957 (PNL-SA-16867) **Chemical exposure evaluation in the Multimedia Environmental Pollutant Assessment System (MEPAS).** Strenge, D.L.; Buck, J.W. Pacific Northwest Lab., Richland, WA (USA). Aug 1989. 6p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC06-76RL01830. (CONF-891072-5: 27. Hanford symposium on health and the environment: multilevel research--molecules to man, Richland, WA

(USA), 18-20 Oct 1989). Order Number DE90002896. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The Multimedia Environmental Pollutant Assessment System (MEPAS) was developed to prioritize environmental problems based on potential impacts to public health. MEPAS methodology and formulations – including description of transport and exposure pathways – are described. In its 1988 Environmental Survey, US Department of Energy's Office of Environment, Safety, and Health used the MEPAS program to evaluate the relative importance of potential environmental problems at 16 defense production facilities across the United States that contain hazardous materials. The Survey analyses included several hundred "cases" associated with the facilities. 3 refs., 1 fig.

5604 Other Environmental Pollutant Effects

Refer also to citation(s) 5219

5958 (AD-A–211612/7/XAB) **Investigation of resonant ac-dc (alternating current-direct current) magnetic field effects. Final report, May 1986-July 1989.** Durney, C.H.; Janata, J.; Rappaport, C.; Kaminski, M.; Bruckner-Lea, C. Utah Univ., Salt Lake City, UT (USA). 10 Jul 1989. 45p. (UTEC–89-036). Available from NTIS, PC A03/MF A01.

Recently reported observations by others indicate that a combination of a weak dc magnetic field and extra-low-frequency ac magnetic fields can produce resonant effects in biological systems. Our studies of resonant magnetic field effects consist of three parts: (1) calculations aimed at identifying the basic mechanism underlying the resonance, (2) measurements of the effects of combined dc and ac magnetic fields on the dc current through plain (containing no channels) planar phospholipid membranes, and (3) measurements of the effects of combined dc and ac magnetic fields on the binding of metallochromic dyes and calmodulin to calcium. The calculations have provided insight and a physical mechanism that explains both frequency and amplitude windows in an elementary model consisting of one charged particle in a viscous medium. The combined dc-ac magnetic fields did affect the dc current through planar phospholipid membranes, but not in every membrane, and not consistently at the same values of magnetic field strength and frequency. No effect of the magnetic fields were seen on the binding of metallochromic dyes and calmodulin to calcium. None of our measurements showed any resonant response like the cyclotron like resonance reported in the literature in diatoms and lymphocytes. Keywords: Magnetic fields; Phospholipid membranes; Calcium bindings; Cyclotron resonance. Reprints. (JHD)

5959 (AD-A–211759/6/XAB) **Base-level management of radio-frequency radiation-protection program. Final report.** Rademacher, S.E.; Montgomery, N.D. Air Force Occupational and Environmental Health Lab., Brooks AFB, TX (USA). Apr 1989. 111p. (USAFOEHL–89-023RC0111DRA). Available from NTIS, PC A06/MF A01.

AFOEHL developed this report to assist the base-level aerospace medical team manage their radio-frequency radiation protection program. This report supersedes USAFOEHL Report 80-42, 'A practical R-F Guide for BEES.'

5960 (AD-A–211787/7/XAB) **Base-level management of radio-frequency radiation-protection program. Final report.** Rademacher, S.E.; Montgomery, N.D. Air Force Occupational and Environmental Health Lab., Brooks AFB, TX (USA). Apr 1989. 98p. (AFOEHL–89-023RC0111DRA). Available from NTIS, PC A05/MF A01.

AFOEHL developed this report to assist the base-level aerospace medical team manage their radio-frequency radiation-protection program. This report supersedes USAFOEHL Report 80-42, 'A Practical R-F Guide for BEES.'

5961 (CRIE-T–88044) **Study on the active noise control method and the effect of noise reduction due to the multi-connected branch dusts.** Nakao, Kiyoatsu. Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab. Apr 1989. 36p. (In Japanese). Order Number DE90725003. Available from NTIS (US Sales Only), PC A03/MF A01.

This paper reports the results of experimental studies on the utility of the active noise control method, and the effects of the multi-connected branch pipes silencer, concerning the reduction of noise. In the experiments of active noise control by using ducts, when the canceling sound was produced by the speaker set at the end of the short-length pipe corresponding to the one forth wavelength, the sound pressure of canceling noise was less one sixth as compared with setting the speaker at the wall of pipe. The noise reduction quantity to the random noise by the active noise control method was about as much as 15db. This method is not adaptable for noise with wide ranges of frequency. A branch pipe silencers, when it was used as multi-connected branch pipe, could extend the bounds of noise frequency which was able to be reduced and could increase the noise reduction quality. This silencer can deal with the fluctuation of frequency od noise and has higher practicability. 10 refs., 21 figs.

5962 (PB–89-230221/XAB) **Testimony of James M. Melius, M.D., on the reproductive health of workers using video-display terminals before the Subcommittee on Health and Safety Committee on Education and Labor. United States House of Representatives, June 4, 1986.** National Inst. for Occupational Safety and Health, Atlanta, GA (USA). 4 Jun 1986. 12p. Available from NTIS, PC A03/MF A01.

The testimony describes the design of a study of the reproductive health of video display terminal (VDT) operators. The search for a possible study population lasted more than 2 years. It was finally decided to request participation of employees of the BellSouth and AT&T telecommunications companies at their southwest locations. BellSouth employed a large number of women who spend most of their day working at VDTs. AT&T does similar work, also using a large number of women in the work-force, but without the use of VDTs. The peer review group chosen to evaluate the protocol for the study included four scientists from outside NIOSH and two within. These scientists included three epidemiologists with expertise in reproductive studies, one statistician, and two experts in stress and ergonomics. The study protocol was revised and submitted to the Human Subjects Review Board and subsequently to the Office of Management and Budget. Some concerns surfaced, necessitating several changes in the study protocol. The final version was sent to the peer review panel and the involved companies and labor unions for their further comment. No study results are included.

5963 (PB–89-234850/XAB) **Electric and magnetic fields and contact currents near AM (amplitude modulation) standard broadcast radio stations.** Tell (Richard) Associates, Inc., Las Vegas, NV (USA). 23 Aug 1989. 92p. Available from NTIS, PC A05/MF A01.

This study represents an investigation of the radiofrequency (RF) electromagnetic field environment in the immediate vicinity of AM radio broadcast towers. The study provides additional information that may be useful in more accurately determining the distance from such towers at which RF fields may exceed applicable guidelines for safe human exposure. Electric and magnetic fields were measured at four different AM radio stations in Las Vegas, Nevada. One of the stations was non-directional, and the remaining three employed directional patterns either at night or during the day and night. Radiofrequency currents flowing between guy wires and individuals touching these wires (contact currents) were also briefly investigated.

5964 (PNL-SA–17179) **Introduction to extremely-low-frequency electric and magnetic fields.** Tenforde, T.S. Pacific Northwest Lab., Richland, WA (USA). Jul 1989. 6p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-8907166–1: 8. annual American Statistical Association conference on radiation and health: health effects of electric and magnetic fields: statistical support for research strategies, Cooper Mountain, CO (USA), 9-13 Jul 1989). Order Number DE90002662. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The interaction with living systems of electromagnetic fields in the extremely-low-frequency (ELF) range below 300 Hz will be summarized briefly in this paper. In materials with the electrical and magnetic properties of living tissues, these fields have a long wavelength (5000 m) and skin depth (150 m). As a consequence, in their

interactions with humans and other living organisms ELF fields behave as though they are composed of independent electric and magnetic components of an ELF field is commonly referred to as the "quasi-static approximation," which permits the radiating properties of the field to be neglected in describing its interaction with living organisms. The electric and magnetic components of an ELF field have several distinctly different features in their interactions with humans and other living organisms. First, the electrical conductivity of tissue is approximately 14 to 15 orders of magnitude greater than that of air at ELF electric fields. Consequently, the body behaves like a good electrical conductor in ELF electric fields. As a result, an electrical charge is developed on the surface of a living object in an external ELF field, but the electric field penetrates into the body only to a very limited extent.

57 HEALTH AND SAFETY

Refer also to citation(s) 4668

5965 (DOE/EH/79072–T2) **Fire protection survey: Revisit No. 2.** Moore, L.J.; King, J.E.; Mattern, J.; Parker, M.; Ramsey, S.; Simmons, J.M.; Young, D.C. Factory Mutual Research Corp., Norwood, MA (USA). Nov 1989. 252p. Sponsored by U.S. DOE Environment Health & Safety. DOE Contract AC01-88EH79072. Order Number DE90002930. Available from NTIS, PC A12/MF A01 - OSTI; GPO Dep.

A fire protection survey was conducted by a team for the Department of Energy at Los Alamos National Laboratory (LANL). The purpose of the survey was to review the facility fire protection program and to develop findings or identify areas according to the following criteria established by the Department of Energy: findings which would be discovered as the result of a Highly Protected Risk (HPR) fire inspection of an industrial insured facility, identification of areas where lack of automatic protection in a fire or explosion incident could cause a loss of $1 million in property damage (PD) or greater, identification of areas where Maximum Foreseeable Loss (MFL) potentials exceed $50 million. MFL conditions assume a failure of automatic protection systems and subsequent reliance only on separation, MFL fire walls, or value limitations, and evaluation of adequacy of compliance with recommendations made in prior surveys.

58 GEOSCIENCES

Refer also to citation(s) 4676, 4678, 4748, 4750, 4960, 5219, 5517

5966 (DOE/ER/13962–1) **Precambrian and Mesozoic plate margins: Montana, Idaho and Wyoming with field guides for the 8th international conference on basement tectonics.** Special publication 96. Lewis, S.E.; Berg, R.B. (eds.). Montana Bureau of Mines and Geology, Butte, MT (USA). Jul 1988. 195p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER13962. (CONF-8808218–Suppl.: 8. international conference on basement tectonics, Butte, MT (USA), Aug 1988). Order Number DE90002940. Available from NTIS, PC A10/MF A01 - OSTI; GPO Dep.

Two field trips held in conjunction with the 8th International Conference on Basement Tectonics are the raison d'etre for this volume, which would perhaps otherwise seem an eclectic association. The unifying theme is an investigation of the nature of plate margins in time and space, consonant with the main theme of the conference, Characterization and Comparison of Precambrian Through Mesozoic Continental Margins. Papers presented at the conference will be published in a separate volume by the International Basement Tectonics Association, Inc. The first field trip is at least a preliminary attempt at an overview of the Precambrian (predominantly Archean) crystalline basement of southwestern Montana. A number of interesting investigations have been focused on this region in recent years. Thus, papers in the first part of this volume take the reader from the Stillwater Complex across the Beartooth Plateau, to the northern borders of Yellowstone National Park on to the southern Madison Range, and finally to some of the western-most (probable) Archean exposures in the Highland Mountains south of Butte. Moving considerably forward on the geologic time scale, the other broad topic dealt with in a second field trip and complementary articles is a relatively recent collisional terrane in central Idaho and eastern Oregon. Examined are portions of the Idaho batholith and its enigmatic and fascinating marginal rocks, and to the west, the heart of the suture zone itself in the Wallowa-Seven Devils terrane with its group of exotic intrusive, metavolcanic, and metasedimentary rocks. Individual papers are processed separately for the data base.

5967 (GS–89-1G, pp. 133-157) **The geology, biostratigraphy and organic geochemistry of the Natsek E-56 and Edlok N-56 wells, western Beaufort Sea.** Dietrich, J.R. (Inst. of Sedimentary and Petroleum Geology, Calgary, AB (Canada)); Dixon, J.; McNeil, D.H.; McIntyre, D.J.; Snowdon, L.R.; Cameron, A.R. Geological Survey of Canada, Ottawa, ON (Canada). 1989. (MICROLOG–89-03293). In *Current research, part G. Frontier geoscience program, Arctic Canada.* Available from PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

The Dome Pacific et al. PEX Natsek E-56 and Dome et al. Edlok N-56 wells, drilled in the southwestern part of the Canadian Beaufort-Mackenzie Basin, penetrated thick sections of Tertiary sedimentary strata. The lithology, microfossil content, geochemical characteristics and reflection seismic expressions of the stratigraphic units penetrated by both wells are described in this report. Important results and interpretations include: the recognition and stratigraphic identification of major unconformities of Early and Middle Eocene age, the introduction of the Taglu and Aklak sequence names (as revisions of previous descriptions of the Beaufort-Mackenzie Basin sequence stratigraphy), descriptions of the nature of the sedimentary fill (of the Demarcation sub-basin sequence stratigraphy), descriptions of the nature of the sedimentary fill of the Demarcation sub-basin, and identification of submarine fan deposits in Eocene strata. 16 refs., 16 figs.

5968 (GS–89-1G, pp. 249-256) **Palynostratigraphy of the Esso et al. Issungnak O-61 well, Beaufort Sea.** White, J.M. (Inst. of Sedimentary and Petroleum Geology, Calgary, AB (Canada)). Geological Survey of Canada, Ottawa, ON (Canada). 1989. (MICROLOG–89-03293). In *Current research, part G. Frontier geoscience program, Arctic Canada.* Available from PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

This paper contains a palynelogical analysis of the Esso et al. Issungnak O-61 well in the Beaufort Sea, Arctic Canada. At a depth of 160 to 180 m, the age of the strata is probably no younger than middle Pliocene. No age diagnostic palynomorphs occur at the base of the well (3583 m), but the presence of the foraminifer Turiloina alsatica at 2730 m indicates an Oligocene age. This suggests an Oligocene to Recent stratigraphic range for the pollen taxon Symphoricarpos sp. cf. S. occidentalis. Within the Mackenzie Bay sequence there is a hardwood assemblage that includes several likely temporate arboreal taxa. The upper limits of these taxa occur between 1505 and 1675 m. This possibly represents a Middle Miocene temperature maximum and subsequent marked decline. However, there is a distinct possibility that the assemblage is made up of reworked Paleogene taxa. 33 refs., 2 figs.

5969 (GS–89-1G, pp. 267-272) **The influence of dissolved sulphate on calcite dissolution: A possible link to the problem of dolomitization.** Morrow, D.W. (Inst. of Sedimentary and Petroleum Geology, Calgary, AB (Canada)); Ricketts, B.D. Geological Survey of Canada, Ottawa, ON (Canada). 1989. (MICROLOG–89-03293). In *Current research, part G. Frontier geoscience program, Arctic Canada.* Available from PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN.

The dissolution of calcite in sulphate-bearing and sulphate-free solutions that contain no initial calcium has been investigated in order to delimit controls on the rate of calcite dissolution in natural solutions. Calcite dissolution is an essential part of the limestone

dolomitization process. This process has commonly occurred in many carbonate-hosted hydrocarbon reservoir rocks. The data of this study show that the dissolution of calcite is not inhibited in sulphate-bearing solutions that contain no initial dissolved calcium. This corroborates previous assertions that the extent to which dissolved sulphate retards the rate of calcite dissolution is dependent on the initial calcium concentration. 17 refs., 2 figs.

5970 (GS–142) **Report of activities, 1988: Resident geologists.** Fenwick, K.G.; Giblin, P.E.; Pitts, A.E. (eds.). Geological Survey of Canada, Ottawa, ON (Canada). 1989. 421p. (MICROLOG–89-04004). Available from PC Ontario Ministry of Natural Resources, Public Information Centre, 99 Wellesley St., W, Toronto, ON, CAN M7A 1W3; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN.

This document presents a collection of reports on various research projects and ongoing activities of the Ontario Geological survey. Reports are arranged by geological district, and are mainly concerned with mining, exploration, and related support activities in hard-rock mining districts of the province. A report from the Petroleum Resources Section of the Ministry of Natural Resources is also included. A separate abstract has been prepared for one report from this document.

5971 (NUREG/CR–5417) **Processing and interpretation of seismic reflection data near the Bane Dome in Bland County, Virginia.** Domoracki, W.J. (Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (USA). Dept. of Geological Sciences); Costain, J.K.; Coruh, C. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering; Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (USA). Dept. of Geological Sciences. Nov 1989. 25p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A03/MF A01; OSTI; INIS.

The purpose if this study was to process and interpret a seismic reflection line from Bland County, Virginia, and to compare it to an earlier line in this location. A longer Vibroseis sweep with greater bandwidth was used for the new line, which provided a considerable improvement in signal to noise ratio and resulted in better residual statics. Additional processing steps, including crooked line CDP sort and predictive deconvolution, also led to improved resolution, particularly in the shallow section. The geologic section interpreted from the seismic profile represents a series of fault slices between the St. Clair Narrows thrust plates above autochthonous Lower Cambrian shelf strata. A previously interpreted Eocambrian rift basin is clearly defined on this line; the basin is bounded by a large normal fault at its north end. Seismicity in Bland and Giles counties may originate in reactivated Eocambrian faults which presumably formed during opening of the Proto-Atlantic Ocean. 23 refs., 13 figs.

5972 (PB–89-220909/XAB) **Measurement of recharge rates through an unsaturated glacial till by tritium analyses. Technical report, 1 July 1988-30 June 1989 (Final).** Daniels, D.P.; Fritz, S.J.; Leap, D.I. Purdue Univ., Lafayette, IN (USA). Water Resources Research Center. Jun 1989. 49p. (PWRRC-TR–181). Available from NTIS, PC A03/MF A01.

Measurement of the penetration depth of bomb-derived tritium is a relatively simple, yet effective method for measuring the average annual recharge rate through the vadose zone. The tritium profile obtained in core BN-1, located on the upland till plain near West Lafayette, Indiana showed a definite low-high-low signal at depth, indicating the position of recharge water derived from 1963/64 precipitation. Two other cores, located on a slope topographically lower than BN-1, showed no definite reversal in tritium concentration. This is probably due to lateral flow components at these locations.

5973 (UCRL–102168) **A comparison of spatial averaging and Cadzow's method for array wavenumber estimation.** Harris, D.B.; Clark, G.A. Lawrence Livermore National Lab., CA (USA). 31 Oct 1989. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8910264–2: Asilomar conference on signals, systems and computers, Monterey, CA (USA), 31 Oct 1989). Order Number DE90003603. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We are concerned with resolving superimposed, correlated seismic waves with small-aperture arrays. The limited time-bandwidth product of transient seismic signals complicates the task. We examine the use of MUSIC and Cadzow's ML estimator with and without subarray averaging for resolution potential. A case study with real data favors the MUSIC algorithm and a multiple event covariance averaging scheme.

5974 (VSJ–8901) **Bulletin of volcanic eruptions. Number 26.Annual report of the world volcanic eruptions in 1986.** Volcanological Society of Japan (Japan). Mar 1989. 101p. Order Number DE90724785. Available from NTIS (US Sales Only), PC A06/MF A01.

In response to the resolution by the International Association of Volcanology at General Assembly of IUGG in Helsinki in July-August, 1960, the Bulletins of Volcanic Eruptions were annually issued since 1961. The present issue (Number 26) includes information on volcanic eruptions that occurred in 1986. Miscellaneous informations on the present status of some volcanoes in this year are also included. The information form for the contributors was prepared for the sake of collecting data for volcanic eruptions in as uniform and quantitative a format as possible. This form is adopted for the eruptions from 1971. A draft of the List of the World Active Volcanoes was also prepared. Supplements to previous issues and miscellaneous information are also provided. The Bulletin of Volcanic Eruptions will be distributed to volcanologists of the world who are interested in such information, through the National Committee of each country. 54 figs., 22 tabs.

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5975 (AD-A–211355/3/XAB) **Observations of high-frequency waves in the solar atmosphere.** Keil, S.L.; Mossman, A. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 1989. 14p. (AFGL-TR–89-0205). Available from NTIS, PC A03/MF A01.

Pub. in Solar and Stellar Granulation, 333-345(1989).

An agile (tiltable) mirror was used in conjunction with the echelle spectrograph of the Vacuum Tower Telescope at Sacramento Peak to measure propagating acoustic waves in the solar atmosphere. The agile mirror permits the removal of image motion caused by the earth's atmosphere before feeding the image into the spectrograph. A CCD array was used to record 132 spectral points across the photospheric line Fe I 5434 every 1.5 seconds at 100 spatial points along the spectrograph slit. Spatial resolution along the slit was 0.33 and the spectral resolution is 9.2 mA. The images were stabilized using the signal from a quad-cell locked onto small sunspots or pores. Several, approximately one-hour-long observing runs were made with the slit either crossing the spot or displaced several arcseconds from the spot. Observations were made at disk center and at a heliocentric angle of 37 deg. (cos(theta)=0.8). Phase differences between velocities in the line core and at various bisector levels in the line as a function of frequency were computed. The image stabilization permits wave propagation to be seen out to about 24-28 mHz without any further correction for seeing. After correction for radiative-transfer effects, a flux of energy in the propagating waves was found that is sufficient to heat the chromosphere.

5976 (AD-A–211361/1/XAB) **Correlation lifetimes of quiet and magnetic granulation from the SOUP (Solar Optical Universal Polarimeter) instrument on Spacelab 2.** Title, A.; Tarbell, T.; Topka, K.; Acton, L.; Duncan, D. Air Force Geophysics Lab., Hanscom AFB, MA (USA). Oct 1988. 10p. (AFGL-TR–89-0204). Available from NTIS, PC A02/MF A01.

Pub. in Astro. Lett. and Communications, Vol. 27, No. 3, 141-149(Oct 1988).

The flight of the Solar Optical Universal Polarimeter (SOUP) on Spacelab 2 allowed the collection of time sequences of diffraction-limited (0.5 arc second) granulation images with excellent pointing (0.003 arc second jitter RMS) and freedom from the distortion that plagues ground-based images. The solar 5 minute oscillations are clearly seen in the data. Using Fourier transforms in the temporal

and spatial domain, the authors show that these dominate the autocorrelation lifetime in magnetic regions. When the oscillations are removed the autocorrelation lifetime is found to be 410 and 890 seconds, respectively, in quiet and magnetic regions. In quiet areas exploding granules are common. It is hard to find that neither explodes nor is unaffected by a nearby explosion. A significant fraction of granule lifetimes are terminated by nearby explosions. Local correlation-tracking techniques are used to measure horizontal displacements, and thus transverse velocities, in the intensity field. In the quiet sun it is possible to detect both super- and mesogranulation. Horizontal velocities are as great as 1000 m/s quiet sun, and the average velocity is 400 m/s. In magnetic regions, horizontal velocities are much less, about 200 m/s. These flows effect the measured lifetime. A lower limit to the lifetime in quiet and magnetic sun is estimated to be 440 and 950 seconds respectively.

5977 (AD-A–211448/6/XAB) **Relativistic electrons in Saturn's inner magnetosphere and an estimate of their synchrotron emission. Progress report.** Van Allen, J.A.; Grosskreutz, C.L. Iowa Univ., Iowa City, IA (USA). Dept. of Physics and Astronomy. 1 Jul 1989. 10p. Available from NTIS, PC A02/MF A01.

Pub. in Jnl. of Geophysical Research, Vol. 94, No. A7, 8731-8738(1 Jul 1989).

Energetic electron data obtained during Pioneer 11's two-way traversal of Saturn's inner magnetosphere in September 1979 are reviewed. There were substantial differences between inbound and outbound observations. The inbound data are more likely to represent the time-stationary state. A quantitative model is made for the spatial and spectral distributions of relativistic electrons. The principal features of this model are as follows: (1) The radial dependence of omnidirectional intensity J in the equatorial plane is given by J = k' exp(-1.05 x)1-EXP(-6.5 X). This distribution is applicable to the range 2.30 < or = r < or = 3.60. (2) The latitudinal dependence of J is derived from observed pitch-angle distributions. (3) As shown previously, the energy spectrum is a relatively narrow one with characteristic energies E in MeV at various r as follows: 0.69 at 5.0; 1.10 at 4.0; 1.89 at 3.0; 2.62 at 2.5; and 3.05 at 2.30. The synchrotron emission of the entire population of relativistic electrons in Saturn's inner magnetosphere is estimated to be about 1 kW with a spectral maximum at 720 kHz. It is shown that this radiation will be very difficult, if not impossible, to observe even in the near vicinity of the planet. This paper includes a crude but instructive explication of the truly enormous differences between the synchrotron emissions of the inner magnetospheres of Jupiter and Saturn. Indeed, this comparison was an underlying motive for undertaking the present day.

5978 (AD-A–211685/3/XAB) **Center-to-limb distribution of solar white-light flares. Technical report.** Neidig, D.F.; Wiborg, P.H.; Gilliam, L.B. Air Force Geophysics Lab., Hanscom AFB, MA (USA). May 1989. 54p. (GL-TR–89-0216). Available from NTIS, PC A04/MF A01.

Pub. in National Solar Observatory Technical Report, Rept. No. NSO-TR-89-001, 1-51 (May 1989).

The observed center-to-limb distribution of 61 white light flares (WLFs) are compared with calculated distributions derived from five flare models, each covering different heights, temperatures, and densities in the solar atmosphere. The fundamental assumption in the analysis is that WLFs originate in a single height/temperature regime in the solar atmosphere. If this assumption is correct the WLFs cannot be modeled by a high-altitude optically thin source or by any source located less than 150 km above the tau_{5000} = 1 level, and chromospheric models are acceptable only if the WLFs in the present data base are (statistically) spatially unresolved and have substantial continuum opacity. If the fundamental assumption is wrong, it is speculated that a combination of chromospheric and upper photospheric models can produce center-to-limb distributions that are in satisfactory agreement with observations. These results are entirely independent of spectral analysis, although spectral analysis has, in fact, provided evidence for unresolved structure, substantial continuum opacity, and flare heating in both the chromosphere and upper photosphere of WLFs.

5979 (AD-A–211686/1/XAB) **Observation and interpretation of photospheric line-asymmetry changes near active regions.** Keil, S.L.; Roudier, T.; Campbell, E.; Koo, B.C.; Marmolino, C. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 1989. 10p. (GL-TR–89-0206). Available from NTIS, PC A02/MF A01.

Pub. in Solar and Steller Granulation, 273-281 (1989).

Changes in spectral-line asymmetries between regions of quiet sun and regions containing varying amounts of magnetic flux were observed. The observed asymmetry changes are used to deduce parameters that describe the local state of convective overshoot. From these parameters, the authors deduce how the local convective energy flux depends on magnetic fields within the observed regions. Observations were obtained during five separate observing runs between July 1983 and February 1987. They observe FeI 5434 and FeI 6302. Fe 5434 is not split in magnetic regions while 6302 is used to map out the longitudinal component of the field. Additionally we obtain a K-line slit jaw image to locate areas of plage. The observations indicate that magnetic fields decrease the flux carried by convective elements deep in the photosphere, but permit the elements to overshoot higher into the photosphere and temperature-minimum regions. The quantitative effect on convective transport depends strongly on the strength of the magnetic field.

5980 (AD-A–211700/0/XAB) **MAX '91: The Active Sun: A plan for pursuing the study of the active sun at the time of the next maximum in solar activity, January 1985.** Acton, L. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 17 Aug 1989. 28p. (GL-TR–89-0218). Available from NTIS, PC A03/MF A01.

SOLAR ACTIVITY/research programs; SOLAR CYCLE; MAPS; SOLAR RADIOWAVE RADIATION

5981 (AD-A–211701/8/XAB) **Some statistical properties of the magnetic field in prominences.** Kim, I.; Koutchmy, S.; Stellmacher, G.; Stepanov, A.I. Air Force Geophysics Lab., Hanscom AFB, MA (USA). Jun 1988. 6p. (GL-TR–89-0212). Available from NTIS, PC A02/MF A01.

Magnetic-field observations based on the Zeeman effect, measuring the longitudinal component B1 of the field with an entrance hole of 6.4 arcsec diameter, were obtained for a great number of prominences during 1979 to 1985 using the spectrally scanning magnetograph installed at the coronograph (theta = 53 cm) of the high-altitude Observatory at Kislovodsk (USSR).

5982 (AD-A–211721/6/XAB) **NSO (National Solar Observatory) participation in MAX '91.** Jones, H.; Neidig, D. Air Force Geophysics Lab., Hanscom AFB, MA (USA). Jun 1988. 4p. (AFGL-TR–89-0211). Available from NTIS, PC A02/MF A01.

Pub. in MAX '91: Flare Research at the Next Solar Maximum Workshop (No. 1), 8-9(9-10 Jun 1988).

The National Solar Observatory strongly supports the MAX '91 program and is enthusiastic about participating in MAX '91 observing campaigns. NSO's potential for flare research resides in present or nearly completed instrumentation, including both synoptic facilities (which, by nature of their operations, can be substantially dedicated to supporting MAX '91) and general-purpose instruments. NSO has accumulated considerable observing-campaign experience at both the Kitt Peak and the Sacramento Peak sites, and has policies in place for accommodating observing proposals which cannot be precisely scheduled in advance. As for effective utilization of NSO's facilities, it would be desirable for MAX '91 investigators to engage in collaborations with the NSO scientific staff, whenever possible.

5983 (AD-A–211722/4/XAB) **Photospheric fine structure close to a sunspot.** Von Der Luhe, O. Air Force Geophysics Lab., Hanscom AFB, MA (USA). Jun 1988. 5p. (AFGL-TR–89-0213). Available from NTIS, PC A02/MF A01.

High-resolution observations of the solar photosphere near a sunspot taken in 3 wavelengths simultaneously are described.

5984 (AD-A–211723/2/XAB) **Space-borne coronagraphy.** Koutchmy, S. Air Force Geophysics Lab., Hanscom AFB, MA (USA). May 1988. 51p. (AFGL-TR–89-0217). Available from NTIS, PC A04/MF A01.

Pub. in Space Science Reviews, Vol. 47, 95-143(May 1988).

Consider the main aspects of a rather delicate discipline, space-borne coronagraphy, which is essentially performed with white-light, externally-occulted coronagraphs. Methods of observation and recent results are presented in a scientific section; a short account of historical rocket-borne and balloon-borne experiments is also given.

The review concentrates on both the NRL-type coronagraphs and the HAO-type coronagraphs, stressing the essential features and merits of numerous experiments that were flown. A small section is devoted to other designs. A large number of figures, including many drawings, are used to illustrate the growing complexity of experiments.

5985 (AD-A–211734/9/XAB) **Energy transport.** Neidig, D. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 10 Jun 1988. 7p. (AFGL-TR–89-0210). Available from NTIS, PC A02/MF A01.

Interest is centered on two major questions: (A) what are the mechanisms of flare energy transport, and (B) how do the effects of flares and other transient activity propagate to Earth. The first question is restricted to the transport of energy within the immediate vicinity of the flare energy release - especially to the solar atmosphere along field lines connected to the site of energy release. The second question, in the case of flare-associated disturbances, bears mainly on the restructuring of coronal magnetic fields surrounding, or perhaps involved with, the flare. In the case of coronal mass ejections (CMEs) or other coronal disturbances originating in the apparent absence of flares, the energy release and propagation mechanisms may occur higher in the corona and may be weakly coupled to the solar surface. These mechanisms, for which a fundamental distinction from flares has not been demonstrated, are poorly understood; yet, they may represent the crucial connecting link between solar activity and subsequent geophysical disturbances. Thus, the two major questions posed in Group D are quite separate and require different observational/analytical approaches.

5986 (AD-A–211736/4/XAB) **Magnetic, basal, and radiative-equilibrium components in Mount Wilson Ca II H + K fluxes.** Schrijver, C.J.; Dobson, A.K.; Radick, R.R. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 15 Jun 1989. 11p. (AFGL-TR–89-0214). Available from NTIS, PC A03/MF A01.

Pub. in Astrophysical Jnl., Vol. 341, No. 2, 1035-1044(15 Jun 1989).

Mount Wilson Ca II H + K flux measurements of cool dwarf stars are analyzed comparing the fluxes with stellar Mg U H + K fluxes, variability amplitudes, rotation rates, and solar data. The authors conclude that the Mount Wilson Ca U H + K fluxes comprise three principal parts: (1) a photospheric contribution in the line wings, (2) a basal chromospheric component that appears to be unrelated to stellar magnetic activity and is therefore possibly nonmagnetic in origin, and (3) a chromospheric component that they associate with magnetically active regions and the (quiet and active) network. The basal chromosphere appears to cover the entire surface of magnetically inactive stars. The basal Ca II H + K flux density for solar-type stars equals the average emission observed in the center of solar supergranulation cells, where the magnetic flux density is small.

5987 (AD-A–211743/0/XAB) **Properties of a concentrated magnetic-field region.** Koutchmy, S.; Stellmacher, G. Air Force Geophysics Lab., Hanscom AFB, MA (USA). Oct 1986. 9p. (GL-TR–89-0215). Available from NTIS, PC A02/MF A01.

Pub. in Proceedings of the Inaugural Workshop and Round Table Discussion for the D-E-S Telescope Installations on the Canary Islands, 103-109 (6-12 Oct 1986).

Theoretic models of photospheric concentrated flux regions were worked out by different authors which appear to reproduce the most significant observations, for the fact that no important flows are observed within the magnetic structures.

5988 (DOE/FTR–90002424) **[Gallium solar neutrino experiment]: Foreign trip report, September 18–September 27, 1989.** Hahn, R.L.; Hartmann, F.X. Brookhaven National Lab., Upton, NY (USA). 23 Oct 1989. 16p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. Order Number DE90002424. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This tenth in the series of GALLEX workshops brought together the members of the Collaboration with the main purpose of reviewing progress in the design, construction, installation and testing of the experimental apparatus. All of the major pieces of apparatus needed for the gallium experiment are on hand. The two main components that were behind schedule were finally in place in the GALLEX Main Building in the LNGS tunnel: installation of the two special large tanks that will hold the gallium chloride solution had been completed; and all of the components of the primary extraction system for Ge-71 had been received and were in the process of being conducted. Both of these large-scale efforts were the responsibility of the Karlsruhe group. Twelve tons of gallium are at the LNGS; the full 30 tons are due to be delivered by the end of February, 1990. Initial runs with the gallium neutrino detector are scheduled to begin in March, 1990.

5989 (FNAL/C–89/221-A) **Small scale structure on cosmic strings.** Albrecht, A. Fermi National Accelerator Lab., Batavia, IL (USA). 30 Oct 1989. 20p. Sponsored by U.S. DOE Energy Research; National Aeronautics and Space Administration. DOE Contract AC02-76CH03000. (CONF-8907171–1: Symposium on the formation and evolution of cosmic strings, Cambridge (UK), 2-7 Jul 1989). Order Number DE90003128. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

I discuss our current understanding of cosmic string evolution, and focus on the question of small scale structure on strings, where most of the disagreements lie. I present a physical picture designed to put the role of the small scale structure into more intuitive terms. In this picture one can see how the small scale structure can feed back in a major way on the overall scaling solution. I also argue that it is easy for small scale numerical errors to feed back in just such a way. The intuitive discussion presented here may form the basis for an analytic treatment of the small structure, which I argue in any case would be extremely valuable in filling the gaps in our resent understanding of cosmic string evolution. 24 refs., 8 figs.

5990 (IC–89/169) **Self-organization processes on the sun.** Krishan, V. (International Centre for Theoretical Physics, Trieste (Italy)); Mogilevskij, E.I. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 15p. Order Number DE90610634. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Non-linear interactions between small fluid elements, magnetized or otherwise, in an energetically open system facilitate the formation of large coherent stable structures. This is known as self-organization. We interpret solar granulation on all scales and the formation and evolution of solar active regions to be the result of self-organization processes occurring in a turbulent medium. (author). 18 refs, 1 fig.

5991 (IC–89/184) **On the mass to light ratios of dwarf spheroidal galaxies.** Cuddeford, P. (International School of Advanced Studies, Trieste (Italy)); Miller, J.C. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 11p. Order Number DE90610645. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Previous estimates of the mass to light ratios of local dwarf spheroidal galaxies have indicated they form an inhomogeneous population. We here use a tidal equation and show that if we assume that all of these dwarf galaxies are on essentially similar orbits around the Milky Way (rather than having perigalactica comparable with their present distances) we can derive values of M/L_v which have a much smaller spread and no longer have correlations with luminosity and distance. It is then possible to maintain the view that either all of these dwarf galaxies contain dark matter or none of them do, with the main determining factor being the currently uncertain mass of the Milky Way. (author). 23 refs, 2 tabs.

5992 (IC–89/198) **Disturbance structures and its magnetic field features in plasma comet tail.** Li Zhongyuan. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 10p. Order Number DE90610636. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The solar wind disturbances result in the emergence of condensation structures in plasma comet tail. Most of them are correlated with plasma vortex flow. In this paper, we analyze the features of condensations basing on the theories of MHD and force-free field. Specifically, we discuss the construction and the distribution of magnetic field and its energy in condensations. We also analyze in detail the coupling process between an unsteady plasma motion and a magnetic field. The coupling effect will let the energy in comet tail change into the force-free field in condensations, so that

the magnetic field energy in the condensations increases constantly. Many phenomena observed in comet tail can be explained with the model. (author). 22 refs.

5993 (IC–89/200) **A storage process of the magnetic energy results from the unsteady plasma flow field in the space active regions and stellar atmosphere.** Li Zhongyuan. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 5p. Order Number DE90610638. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

In the discussion about the energy storage by a pure azimuthal motion in the active regions of solar and stellar atmosphere we consider the unsteady poloidal flow field and the unsteady coupling process between the magnetic field and both the toroidal and the poloidal velocity components. 9 refs.

5994 (IC–89/219) **Quantum cosmological origin of large scale structures of the universe.** Anini, Y. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 16p. Order Number DE90610647. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In this paper, the initial quantum state of matter perturbations about de Sitter minisuperspace model is found. For a large class of boundary conditions (bcs), including those of Hartle-Hawking and Vilenkin, the resulting quantum state is the de Sitter invariant vacuum. This result is found to depend only on the regularity requirement at the euclidean origin of spacetime which is common to all reasonable (bcs). The initial value of the density perturbations implied by these quantum fluctuations are found and evaluated at the initial horizon crossing. The perturbations are found to have an almost scale independent spectrum, and an amplitude which depends on the scale at which inflation took place. The amplitude would have the right value if the scale of inflation is $H \leq 10^{15}$Gev. (author). 9 refs.

5995 (IC–89/221) **Void distributions in ACO cluster catalogue.** Jing Yipeng. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 22p. Order Number DE90610639. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

We measured the count probabilities in the new Abell catalogue for clusters of different distance and of different richness. Void distribution functions suggest that Abell clusters are distributed with scale invariance, and this scaling is independent of richness. Comparing to the scaling model of Schaeffer, our results favour the model of the free parameter $\nu = 0$. (author). 29 refs, 1 tab., 5 figs.

5996 (IC–89/222) **A comparison of void distributions in Abell cluster catalogue with numerical simulations.** Jing Yipeng. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 17p. Order Number DE90610640. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

We measured the void probability functions (VPF) for two virtually redshift complete samples of Abell clusters, and used them to test four current theoretical models. The VPF of $R \geq 1$ clusters is lower than that of the explosion model by about one order. The open CDM model ($\Omega = 0.2$) is excluded at $\geq 3\ \sigma$ also due to oversuperclustering. The VPF of the flat neutrinos dominated universe is consistent with the observations, and the flat CDM model could be marginally accepted at $2\ \sigma$ in matching the observational VPF. However, all four models are unsuccessful if we combine the two-point correlation function and VPF. (author). 15 refs, 3 figs.

5997 (IC–89/299) **A new interpretation of the feature of SiO maser spectra associated with M-type star.** Liu Hanping (International Centre for Theoretical Physics, Trieste (Italy)); Sun Jin. International Centre for Theoretical Physics, Trieste (Italy). Sep 1989. 9p. Order Number DE90610641. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

There exists a systematic redshift of spectra (ν=1,2; J=1-0) of SiO masers associated with a number of late-type M stars. On the contrary, the redshift is rather small for the spectra (ν=1; J=2-1). The latter is approximately symmetrical with respect to the star. For the above, no good interpretation has been given up to now. A new redshift mechanism of SiO spectra, the mechanism of radiation frequency shift, has been derived here from the interaction between the radiation field of the star and the energy levels of the maser. Detailed calculations show that, under the influence of the radiation field of the star, the redshift of the SiO spectra (J=1-0) is more substantial than that of the spectra (J=2-1). This is consistent with the result of the observation, and shows that the non-kinematic effect of the spectra is non negligible for the SiO maser of the star. (author). 10 refs, 1 fig., 1 tab.

5998 (JINR-R–2-88-654) **Elementary particles and cosmology: Lectures for young scientists.** Dobrolyubov, M.I. (AN SSSR, Moscow (USSR). Inst. Yadernykh Issledovanij); Ignat'ev, A.Yu.; Shaposhnikov, M.E. Joint Inst. for Nuclear Research, Dubna (USSR). 1988. 48p. (In Russian). Order Number DE90610648. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Series of lectures is devoted to actual problems which arise at the junction of elementary particle physics and cosmology. Brief review is given to the standard theory of hot universe and scenario of inflationary universe, modern state of the problem of baryon universe asymmetry and possible new mechanisms of this asymmetry formation. Possibility of constuction of cosmological models on the basis of supersymmetric theories is considered: qualitative evaluation of the modern density of relic particles, cosmolological restrictions for the mass of the lightest sparticle, astrophysical restrictions for the coupling constant of weakly interacting particles and matter are given. Perspective direction of search for light sparticles in light hadron decays is mentioned. 47 refs.; 18 figs.

5999 (LA-UR–89-3772) **Pulsations of delta Scuti stars.** Cox, A.N. Los Alamos National Lab., NM (USA). [1989]. 30p. Sponsored by U.S. DOE Management & Administration. DOE Contract W-7405-ENG-36. (CONF-8910308–1: 5. Florida workshop in nonlinear astronomy: nonlinear astrophysical fluid dynamics, Gainesville, FL (USA), 5-7 Oct 1989). Order Number DE90003213. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A general review of the pulsating δ Scuti variables is given including the observed light curves and positions of the stars in the Hertzsprung-Russell diagram. Theoretical interpretations from evolution and pulsation calculations give their masses, radii, luminosities, and even their approximate internal compositions. Three models of these stars are discussed and used to study the nonlinear hydrodynamic behavior of these stars. The hydrodynamic equations and the Stellingwerf method for obtaining strictly periodic solutions are outlined. Problems of allowing for time-dependent convection and its great sensitivity to temperature and density are presented. Tentative results to date do not show any tendency for amplitudes to grow to large unobserved amplitudes, in disagreement with an earlier suggestion by Stellingwerf. It is found that the very small growth rates of the pulsations may even be too small to be useful in seeking a periodic solution. 15 refs., 8 figs., 3 tabs.

6000 (N–89-25818) **Solar physics in the space age.** National Aeronautics and Space Administration, Washington, DC (USA). 1989. 53p. (NAS–1.83:106). Available from NTIS, PC A04/MF A01.

A concise and brief review is given of the solar physics' domain, and how its study has been affected by NASA Space programs which have enabled space based observations. The observations have greatly increased the knowledge of solar physics by proving some theories and challenging others. Many questions remain unanswered. To exploit coming opportunities like the Space Station, solar physics must continue its advances in instrument development, observational techniques, and basic theory. Even with the Advance Solar Observatory, other space based observation will still be required for the sure to be ensuing questions.

6001 (N–89-27612) **Commentary on interstellar matter associated with 18 open clusters.** Leisawitz, D. National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center. Sep 1989. 20p. (NASA-RP–1229;REPT–89B00238;NAS–1.61:1229). Available from NTIS, PC A03/MF A01.

Information supplementary to that contained in Section 4 of an article entitled, A CO Survey of Regions Around 34 Open Clusters, (Leisawitz, Bash, and Thaddeus) published in the Astrophysical Journal Supplement Series, Volume 70, Number 4, August 1989 is summarized. The information presented here, which describes the interstellar environments of young clusters and some cluster physical characteristics, comes from observations published in the astronomical literature and the author's carbon monoxide (CO)

emission line survey, and may help clarify our understanding of the interaction of massive stars with the interstellar medium.

6002 (UCRL–102150) **Astophysical opacities at LLNL.** Iglesias, C.A.; Rogers, F.J. Lawrence Livermore National Lab., CA (USA). 2 Aug 1989. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890520–3: International conference: inside the sun, Versailles (France), 22-26 May 1989). Order Number DE90003599. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

In an effort to reduce uncertainties in the theoretical radiative opacities a new code has been developed at LLNL which removes several of the approximation present in past calculations. Results from the new code with comparisons to other available opacity calculations are presented as well as experiments. 20 refs., 2 figs., 1 tab.

6003 **Mixing core material into the envelopes of red giants.** Deupree, R.G. (Los Alamos National Lab., Los Alamos, NM (US)). pp. 422 of Stellar pulsation. Cox, A.N. Sparks, W.M. Starrfield, S.G Springer-Verlag New York Inc., New York, NY (1987). (CONF-8608130–: Stellar pulsation conference, Los Alamos, NM (USA), 11-15 Aug 1986).

In this paper, the author extends the work by Cole and Deupree and Deupree to examine how much residue of the core helium flash can be mixed into and above the hydrogen shell. The starting point for these calculations is a point source explosion on the polar axis of a two-dimensional finite difference grid. Deupree showed that this well reproduces the results of a full three-dimensional calculation initiated with a stellar evolution structure. The point source explosion produces a high temperature, low density bubble of processed material whose peak temperature and hence composition depends on the degeneracy at the position and time of the explosion. This bubble will be mostly helium and carbon. He performed four core helium flashes with peak temperatures of 7.4, 8.3, 9.2, and $10.2X10^8$ K. In all cases carbon is the heavy element with the greatest amount of mass mixed. This is followed by neon in Cases 1 and 2, silicon in Case 3, and sulfur in Case 4.

6004 **Evolution of Cepheids with pulsationally driven mass loss.** Brunish, W.M. (Los Alamos National Lab., Los Alamos, NM (US)). pp. 422 of Stellar pulsation. Cox, A.N. Sparks, W.M. Starrfield, S.G Springer-Verlag New York Inc., New York, NY (1987). (CONF-8608130–: Stellar pulsation conference, Los Alamos, NM (USA), 11-15 Aug 1986).

The authors have run models of intermediate mass stars (5, 6, 7, and 8 M_Θ with Y=0.28, Z=0.02) with pulsationally driven mass loss occurring in the Cepheid instability strip. They used the new $^{12}C(\alpha,\gamma)^{16}O$ rates of Caughlan et. al. The enhanced rate extends the tip of the blue loop, allowing the 5 and 6 M_Θ models to re-enter the Cepheid strip, unlike the models calculated using the old rates. They attempted to see if mass loss during the Cepheid stage could redden the tip of the blue loop sufficiently to place it inside the instability strip, thereby trapping the star, and allowing it to lose mass for a period of time significantly longer than the normal crossing time. The authors results show that this mechanism does in fact work for a 7 M_Θ star with mass loss rates as low as $-5x10^{-7}$ M_Θ yr^{-1}. Observations of P-Cygni profiles in Cepheids indicate that this rate is not unreasonable.

6005 **HH111 jet and multiple outflow episodes from young stars.** Reipurth, Bo (European Southern Observatory, Santiago (Chile)). *Nature (London) (UK)*, 340(6228): 42-45 (6 Jul 1989).

Herbig-Haro jets are shocked beams of gas escaping supersonically from new-born stars. Here I report the discovery of an exceptionally fine jet, HH111, emerging from the young star still embedded in the Orion molecular clouds. The jet system displays four bow-shock-like features, moving in pairs in opposite directions from a 25-L solar mass infrared source. With an extent of more than 0.8 parsec, HH111 is the largest bipolar Herbig-Haro flow known. It is argued that such jets are highly transient phenomena that are related to eruptive accretion events in the build-up of the central star. (author).

6006 **Silicon carbide and the origin of interstellar carbon grains.** Frenklach, M. (Pennsylvania State Univ., University Park, PA (USA)); Carmer, C.S.; Feigelson, E.D. *Nature (London) (UK)*, 339(6221): 196-198 (18 May 1989).

The mechanisms of interstellar grain formation are not well understood. Such grains are complex, with components that include silicates, ices and carbonaceous material. Several forms have been proposed for interstellar carbon, including polycyclic aromatic hydrocarbons (PAHs). The stellar winds of carbon-rich red-giant stars are the dominant source of interstellar carbon grains. However, the processes leading to the formation of grains are usually discussed only in the general terms of thermodynamics and classical nucleation theory. One possibility is that PAH condensation initiates the formation of grains, similar to the formation of soot in hydrocarbon pyrolysis and combustion. A recent computational study demonstrates, by detailed chemical kinetics modelling, that PAHs can, under certain conditions, form in carbon-star molecular envelopes within a 900-1,100-K temperature regime. Although homogeneous gas-phase condensation of PAHs might lead to the formation of grains, we suggest instead that SiC nucleates at higher temperatures and provides a surface for subsequent carbon condensation. Here we present experimental evidence in support of this idea. (author).

6007 **Discovery of a type Ia supernova at a redshift of 0.31.** Noergaard-Nielsen, H.U. (Danish Space Research Inst., Lyngby (Denmark)); Hansen, L.; Joergensen, H.E.; Salamanca, A.A.; Ellis, R.S.; Couch, W.J. *Nature (London) (UK)*, 339(6225): 523-525 (15 Jun 1989).

Observations indicate that nearby supernova of type Ia have similar peak brightnesses, with a spread of less than 0.3mag, so that they can potentially be used as 'standard candles; to estimate distances on a cosmological scale. As part of a long-term search for distant supernovae, we have identified and studied an event that occurred in a faint member of the distant galaxy cluster AC118, at a redshift of z=0.31. Extensive photometry and some spectroscopy of the event strongly supports the hypothesis that we have detected a type Ia supernova whose time-dilated light curve matches that of present-day supernova of this class. We discuss the precision to which its maximum brightness can be ascertained, and indicate the implications that such deep supernovae searches may have for observational cosmology. (author).

6402 Atmospheric Physics

Refer also to citation(s) 5985

6008 (AD-A–211298/5/XAB) **Preliminary investigation of Faraday rotation effects and description of polarization measurements on the AFGL (Air Force Geophysics Lab) high-latitude meteor scatter test bed. Final report, June 1988-May 1989.** Ostergaard, J.C. Elektronikcentralen, Hoersholm (Denmark). 1 Jan 1989. 57p. Available from NTIS, PC A04/MF A01.

The background, methodology, and preliminary results of an investigation of Faraday-rotation effects on the Meteor Scatter High Latitude Test Bed in Greenland are presented. A short review of polarization theory for radio waves, presenting basic properties and changes when reflected from the surface of the earth or propagated through the ionosphere is included. Material published by other workers is presented to give the background for the current interest in Faraday rotation on meteor-scatter links. Propagation losses for meteor scatter paths originate from spatial spreading of Rf energy, scattering losses at the meteor trail, ionospheric absorption, and polarization mismatch at the receiving antenna. That part of the polarization mismatch generated by the ionosphere, the Faraday rotation, is described and evaluated. A method to compute the Faraday rotation is presented, and results obtained for the AFGL MSHL Test Bed are given. An experiment, including the measurement of signal strength and polarization throughout the lifetime of the individual meteor scatter return is needed to fully assess the combined affects of absorption and depolarization during both quiet and disturbed ionospheric conditions. The measurement accuracy to be expected from a proposed experiment is evaluated. A few examples of meteor scatter returns obtained with a prototype experiment in Greenland are shown and discussed.

6009 (AD-A–211353/8/XAB) **Vacuum ultraviolet backgrounds from space - ten years after.** Huffman, R.E.; Larrabee,

J.C.; LeBlanc, F.J. Air Force Geophysics Lab., Hanscom AFB, MA (USA). Aug 1989. 11p. (AFGL-TR–89-0197). Available from NTIS, PC A03/MF A01.

The past ten years has seen progress in the understanding of the ultraviolet background of the earth's atmosphere. These airglow, auroral, and scattering emission sources set limits on the usefulness of UV for space observations. They also, however, enable several types of passive remote sensing; such as, electron-density profiles, neutral density and composition, and auroral location and strength. This paper describes the authors measurements and data analysis in the these areas. UV imaging the aurora has been achieved by four experiments, and these are briefly reviewed. UV imaging has opened up a new way to study solar-terrestrial relationships.

6010 (AD-A–211358/7/XAB) **Spatial characteristics of airglow and solar-scatter radiance from the earth's atmosphere.** Huguenin, R.; Wohlers, R.; Weinberg, M.; Huffman, R.; Eastes, R. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 9 Aug 1989. 13p. (AFGL-TR–89-0200). Available from NTIS, PC A03/MF A01.

Data measured by the Polar BEAR/AIRS UV Experiment were processed to extract spatial-radiance characteristics. Photometer-mode 1304A dayside data measured on Julian Day 219, 1987, near mid-day were analyzed. The spatial structure of thermospheric dayside radiance at 1304A appeared to be controlled principally by turbulence over spatial scales of 10 million - 100 meters, with modifications imposed by Rayleigh-scattering effects and magnetospherically forced phenomena. Spatial structure can be adequately modeled fractally, using dimensions based on Kolmogorov formalism modified by the Rayleigh scattering phase function. Mean radiance can be modeled using existing models of radiant intensity, resonance scattering, and absorption combined with thermospheric composition and general circulation models, such as MSIS-83, scaled to the mean and RHS intensities measured by Polar BEAR. The results can be incorporated in a background radiance simulation model that will provide a means for testing and refining phenomenological models of the structured earth background. This will be important not only for improving physical and chemical models of atmospheric features and processes, but it will allow parametric predictions of spatial structure and clutter to be developed for sensor applications.

6011 (AD-A–211359/5/XAB) **Uv (ultraviolet) ionospheric remote sensing with the Polar Bear satellite.** DelGrecro, F.P.; Eastes, R.W.; Huffman, R.E. Air Force Geophysics Lab., Hanscom AFB, MA (USA). 8 Aug 1989. 6p. (AFGL-TR–89-0199). Available from NTIS, PC A02/MF A01.

This paper presents a brief description of some recent work interpreting and analyzing data obtained by the AIRS sensor on the Polar BEAR satellite. The Polar BEAR satellite was launched in November 1986 into a nearly circular 1000 km orbit with an orbital inclination of 89.5 degrees and a nodal regression of 0.05 degrees per day. In the course of a year the satellite experiences all local times twice a year. One of the instruments on Polar BEAR is the Auroral Ionospheric Remote Sensor (AIRS). AIRS has been described previously and some of the early data from that instrument presented. Briefly, in its primary operating mode AIRS was designed to return four simultaneous images of the atmospheric radiation at Northern latitudes, in the far- and near-ultraviolet (UV) and the visible at 6300 A. Two of the data streams originate from photomultipliers at the exit plane of a one-eighth-meter far-UV spectrometer. The other two data streams originate at photomultipliers behind narrow-band UV and visible filters. A single telescope illuminates both the spectrometer entrance slit and the filtered detectors. In the normal imaging mode of operation, on a three second cycle the line of sight of all four channels is deflected from horizon to horizon perpendicular to the orbital path by a plane mirror at the entrance to the telescope.

6012 (AD-A–211553/3/XAB) **TEC (total electron content) models. Report for 3 February 1988-2 February 1989.** Mazzella, A.J.; Larson, K.P.; Dickson, P. RDP, Inc., Waltham, MA (USA). 15 Mar 1989. 26p. (SCIENTIFIC–2). Available from NTIS, PC A03/MF A01.

Models of the ionosphere were developed and utilized to evaluate Total Electron Content for various specified transmission paths from the ground into space.

6013 (AD-A–211720/8/XAB) **HIPAS 1987-88: ULF (ultralow frequency) research and campaign support. Final report.** Olson, J.V. Alaska Univ., Fairbanks, AK (USA). Geophysical Inst. 18 Aug 1989. 3p. Available from NTIS, PC A02/MF A01.

During the October campaign several intervals were noted in which naturally occurring ULF signals were present during Dr. Ferraro's ELF heating experiments. A one-to-one correlation was found between the ULF and ELF polarization characteristics. ULF pulsations are the result of resonant hydromagnetic waves standing in the earth's magnetic field. They drive currents in the ionosphere, primarily at E-region heights above 100 km. The heating experiment, which produced ELF returns, heated electrons below 100 km in the D region. The correlation led us to a series of studies of the casual link between the ULF and ELF signals. A second campaign was held during July 1988. In preparation for this campaign, two data-acquisition systems were acquired and placed at two sites in Alaska to supplement the Alaska meridian chain of magnetometers. The first system was placed in Tok, Alaska and the second in Coldfoot, Alaska and both were operated continuously during the period of the campaign. These two sites give us measures of the magnetic fields, and hence the ionospheric currents over a two-dimensional region rather than the one dimensional estimate available using only the Alaska meridian chain.

6014 (IRF–201) **Stability analysis and reconstruction of wave distribution functions in warm plasmas.** Oscarsson, T.E. (Umeaa Univ. (Sweden). Swedish Inst. of Space Physics, Umeaa Div.). Swedish Inst. of Space Physics, Kiruna (Sweden). May 1989. 90p. Order Number DE90610822. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

The purpose of this thesis is first to describe stability analysis and reconstruction of the wave distribution function (WDF) separately, and then to show how the two approaches can be combined in an investigation of satellite data. To demonstrate the type of stability investigation that is often used in space physics we study instabilities below the local proton gyrofrequency which are caused by anisotropic proton distributions. Arbitrary angles between the wavevector and the background magnetic field are considered, and effects of warm plasma on the wave propagation properties are included. We also comment briefly given on an often-used scheme for classifying instabilities. In our discussion on WDF analysis we develop a completely new and general method for reconstructing the WDF. Our scheme can be used to reconstruct the distribution function of waves in warm as well as cold plasma. Doppler effects introduced by satellite motion are included, and the reconstructions can be performed over a broad frequency range simultaneously. The applicability of our new WDF reconstruction method is studied in model problems and in an application to observations made by the Swedish satellite Viking. In the application to Viking data we combine stability and WDF analyses in a unique way that promises to become an important tool in future studies of wave-particle interactions in space plasmas. (author).

6015 (OUP–89-05) **Midday auroral breakup events and related energy and momentum transfer from the magnetosheath.** Sandholt, P.E. (Oslo Univ. (Norway). Fysisk Inst.); Lybekk, B.; Egeland, A.; Lockwood, M.; Freeman, K.S.; Willis, D.M.; Oguti, T.; Cowley, S.W. Oslo Univ. (Norway). Fysisk Inst. Apr 1989. 53p. Order Number DE90609834. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Combined observation by meridan scanning photometers, all-sky auroral TV camera and the EISCAT radar, permitted a detailed analysis of the temporal and spatial development of the midday auroral breakup phenomenon and the related ionospheric ion flow pattern within the 71° to 75° invariant latitude radar field of view. The observations reported are considered to be strong evidence of transient reconnection at the dayside magnetopause. Furthermore, the observed relationship between the optical signature and the ion drift observations is found to be consistent with a twin-vortex flow/current pattern in the ionosphere. The geomagnetic signatures are also in accord with this interpretation. 79 refs.

6016 On the over-collection of electrons by high voltage probes in space. Cooke, D.L. (AFGL/PHK Hanscom AFB, MA (US)); Katz, I.; Jongeward, G.; Mandell, M. pp. 160 of Conference

record of the 1988 IEEE international conference on plasma science (abstracts). IEEE Service Center, Piscataway, NJ (1988). (CONF-880651–: IEEE international conference on plasma science, Seattle, WA (USA), 6-8 Jun 1988).

Technical Paper 2D6.

It has been two decades since Parker and Murphy proposed a theory to place a rigorous upper bound on the current to an electron collecting probe in space, due to the influence of the geomagnetic field. Any greater current is then thought to involve some form of anomalous cross field transport to explain over-collection. Over-collection is commonly observed and is usually explained by invoking turbulence as a source of collisions. Although the turbulence hypothesis has some theoretical basis, no compelling kinetic theory or model has been put forth. Another possible explanation for over-collection is the ionization of the neutral gas within the charge sheath. Recently, in support of the SPEAR I rocket experiment, the three dimensional code POLAR has been used to model electron collection in a low earth orbit plasma. SPEAR I was a sounding rocket experiment that exposed to the space plasma, a pair of 10cm spherical probes biased to 44kV positive. The POLAR runs included single sphere, two sphere, and two sphere plus rocket modes. The single sphere model did not predict collection in excess of the Parker-Murphy limit. Models of two sphere collection, and of the entire experiment do however show that increased collection is possible as a result of asymetries introduced by geometry and a negative rocket body potential. These models were in close agreement with the experiment. In addition to the symmetry factor, sheath ionization is reviewed. A discussion of the role and kinetic nature of collisionless turbulence is presented.

6403 Atomic, Molecular, and Chemical Physics

Refer also to citation(s) 5461, 5680, 5701, 5712, 6235, 6236

6017 (AD-A–211372/8/XAB) **Laser production of soft x-rays by multiquantum processes and the excitation of atomic inner-shell states. Progress report.** Rhodes, C.K.; Luk, T.S.; McPherson, A.; Boyer, K. Illinois Univ., Chicago, IL (USA). Lab. for Atomic Molecular and Radiation Physics. 6 Jul 1989. 58p. Available from NTIS, PC A04/MF A01.

Atomic and molecular materials exhibit complex behavior when exposed to strong externally applied fields. This research goal is to understand the nonlinear processes governing the coupling of intense radiation to atomic and molecular matter. The general amplitude under study is N gamma + X yields X (sup q+) + qe(-) + gamma', a class of processes which involves ionization with the collateral production of energetic electrons and radiation. Recently developed ultraviolet light sources are enabling the attainment of focal intensities such that the strong field regime can now be systematically studied. It was anticipated that such conditions would produce unusual excited states of matter and that expectation has been confirmed by recent experimental findings revealing the direct multiphoton production of inner-orbital (2 sigma/g) excited states of N2(+) and N2(2+). Indeed, it can be shown that the strong-field coupling represents a unique mode of interaction that combines (1) the application of strong electromagnetic forces with (2) a very small collateral transfer of energy. This regime is impossible to achieve with charged particle collisions or with low-intensity radiation of any frequency. Interactions of this type are particularly effective in exciting electronic motions along specific molecular axes, enabling the generation of new forms of highly excited matter regardless of molecular structure or composition.

6018 (ANL/PPRNT–89-187) **Time-dependent aspects of electron degradation: 4, Subexcitation electrons in nitrogen and carbon dioxide.** Kimura, Mineo; Inokuti, Mitio; Kowari, Kenichi; Dillon, M.A.; Pagnamenta, A. Argonne National Lab., IL (USA). 1988. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE90002997. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We discuss here the temporal behavior of subexcitation electrons and the yields of products due to these subexcitation electrons. Our examples concern cases in which resonance scattering of electrons occurs, such as vibrational and rotational excitation in N_2 and negative-ion formation in CO_2. One focus of the present work is a test of the continuous-slowing-down-approximation (CSDA) which we compare to the full solution of the time-dependent Spencer-Fano theory, which has been developed recently. 11 refs., 6 figs., 1 tab.

6019 (BNL–43514) **Testing atomic mass models with radioactive beams.** Haustein, P.E. Brookhaven National Lab., Upton, NY (USA). [1989]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-891044–2: 1. international conference on radioactive nuclear beams, Berkeley, CA (USA), 16-18 Oct 1989). Order Number DE90003630. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Significantly increased yields of new or poorly characterized exotic isotopes that lie far from beta-decay stability can be expected when radioactive beams are used to produce these nuclides. Measurements of the masses of these new species are very important. Such measurements are motivated by the general tendency of mass models to diverge from one another upon excursions from the line of beta-stability. Therefore in these regions (where atomic mass data are presently nonexistent or sparse) the models can be tested rigorously to highlight the features that affect the quality of their short-range and long-range extrapolation properties. Selection of systems to study can be guided, in part, by a desire to probe those mass regions where distinctions among mass models are most apparent and where yields of exotic isotopes, produced via radioactive beams, can be optimized. Identification of models in such regions that have good predictive properties will aid materially in guiding the selection of additional experiments which ultimately will provide expansion of the atomic mass database for further refinement of the mass models. 6 refs., 5 figs.

6020 (CONF-890813–2) **Fluorescence dynamics and cross relaxation of 4+ curium in cerium tetrafluoride.** Liu, G.K.; Beitz, J.V. Argonne National Lab., IL (USA). [1989]. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 7. international conference on dynamical processes in excited states of solids; Athens, GA (USA); 28 Aug - 2 sep 1989. Order Number DE90003795. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Fluorescence from Cm^{4+} has been observed for the first time. The dynamics of its emitting 5f state have been probed using time- and frequency-resolved laser-induced fluorescence. Nonexponential fluorescence decays were found from $Cm_{0.001}Ce_{0.999}F_4$ and $Cm_{0.05}Ce_{0.95}F_4$ at temperatures from 4.2 K to 300 K. A simple cross-relaxation model was found to fit the excited f-state dynamics of the $Cm_{0.001}Ce_{0.999}F_4$ sample at low excitation intensity whereas an exciton-exciton annihilation model was necessary to model the observed fluorescence decay as exciton number density increased at higher excitation intensity. The annihilation model, modified to account for a small amount of trap site emission, was required to fit all the observed decays from the $Cm_{0.05}Ce_{0.95}F_4$ sample. 15 refs., 2 figs.

6021 (DOE/ER/13500–T1) **Spectroscopy, reaction, and photodissociation of highly vibrationally excited molecules: Progress report, March 1989–October 1990.** Wisconsin Univ., Madison, WI (USA). [1989]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER13500. Order Number DE90003172. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This research is designed to determine the nature of highly vibrationally excited molecules, probe unimolecular reactions at the level of individual quantum states, and study the dynamics of electronic photodissociation from highly vibrationally excited states. In our experiments, pulsed laser excitation of a vibrational overtone transition prepares a highly vibrationally excited molecule and time-resolved spectroscopic detection of products monitors their subsequent decomposition. We have used this scheme to follow unimolecular reactions of large and small molecules in both room temperature gases and supersonic expansions and to investigate the role that vibrational excitation plays in electronic photodissociation dynamics. These latter experiments, which we designate vibrationally mediated photodissociation, potentially determine the nature of the initial state prepared by vibrational overtone excitation as well as reveal unique electronic photodissociation dynamics for vibrationally excited molecules. 8 refs.

6022 (DOE/ER/13700–2) **Determination of stepsize parameters for intermolecular vibrational energy transfer: Progress report for the period May 1, 1988–April 30, 1989.** Tardy, D.C. Iowa Univ., Iowa City, IA (USA). Jun 1989. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-87ER13700. Order Number DE90003346. Available from NTIS, PC A; OSTI; INIS; GPO Dep.

The understanding of intermolecular vibrational energy transfer (IVET) is important since it is involved in any mechanism in which internal energy is added or removed from molecules. The database for the details of IVET for highly excited polyatomic molecules is inadequate and must be expanded. The overall objectives of this project are: (1) to determine the dependence of energy relaxation on excitation energy and on the molecular complexity of substrate and deactivator, (2) to assess the importance of intermolecular attractions on IVET, (3) to obtain more detailed information on the energy distribution after collision, and (4) to evaluate the importance of IVET on high temperature unimolecular reactions. The first three objectives are being met by experimentally measuring the time evolution of the average energy of the vibrationally excited species (hydro- and fluoro- carbons excited by a pulsed CO_2 laser) and the average energy transferred into relative translation via time resolved IR spectrometry, interferometry and optoacoustic techniques. Trajectory calculations simulating IVET are being performed for model substrate/deactivator pairs to provide additional details and insight on the critical parameters. Our calculations for high temperature unimolecular reactions indicate that IVET effects are significant and must be correctly taken into account. 9 refs., 3 figs., 6 tabs.

6023 (ENEA-RT-TIB–89-03) **A collection of electron excitation collision strengths for iron ions : Fe 26-Fe 18.** Frisoni, M.; Ottaviani, P.L.; Panini, G.C. ENEA, Bologna (Italy). Dipt. Tecnologie Intersettoriali di Base. Apr 1989. 231p. Order Number DE90724618. Available from NTIS (US Sales Only), PC A11.

An updated (up to December 1987) collection of data on electron impact excitation of iron ions, from Fe 26 to Fe 28, is presented. Results obtained with different theoretical approximations are compared to review the current status of certainty as a necessary step to obtain 'recommended' data. For each ion, the data are given in tabular and graphic form and a comprehensive bibliography is also supplied.

6024 (HD-PY–87/12) **Electron attachment to oxygen, water, and methanol, in various drift chamber gas mixtures.** Huk, M.; Igo-Kemenes, P.; Wagner, A. Heidelberg Univ. (Germany, F.R.). Physikalisches Inst. 1987. 31p. Order Number DE90728992. Available from NTIS (US Sales Only), PC A03/MF A01.

Attachment of electrons to oxygen, water, and methanol molecules has been studied in various gas mixtures based on argon, methane and isobutane, a class of gases often used to operate large drift chambers. The measurements were performed using a drift chamber in which the conditions prevailing in large experiments could be closely reproduced. Attachment coefficients were extracted as a function of the gas composition and pressure, the drift field, and the concentration of the molecules under investigation. The observed effects are compared to other measurements, and are discussed within the frame of physical models. (orig.).

6025 (INP–1305/PS) **Dynamics in liquid crystals.** Janik, J.A.; Janik, J.M. Institute of Nuclear Physics, Cracow (Poland). 1986. 20p. Order Number DE90610539. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Five types of reorientational motions for molecules in liquid crystals are discussed on the basis of a comparison of the neutron scattering and the dielectric relaxation methods. 18 refs., 7 figs., 2 tabs. (author).

6026 (INP–1312/PS) **The quasielastic neutron scattering study of the reorientation of the 1,2-bis [4-decyloxybenzoyl]-hydrazine molecules.** Chledowska, K.; Janik, B. Institute of Nuclear Physics, Cracow (Poland). 1986. 11p. Order Number DE90610540. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Two models of the picosecond reorientation of the 1,2-bis/4-n-decyloxybenzoyl/-hydrazine molecules are applied to describe the quasielastic neutron scattering spectra. 4 refs., 2 figs., 3 tabs. (author).

6027 (INP–1316/PS) **Molecular reorientations in the nematic and rotatory phases of di-n-pentyloxyazoxybenzene.** Nguyen, X.P. (Institute of Nuclear Physics, Cracow (Poland)); Krawczyk, J.; Chrusciel, D. and others. Institute of Nuclear Physics, Cracow (Poland). Apr 1986. 25p. Order Number DE90610541. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Results of dielectric relaxation (DR), quasielastic neutron scattering (QNS), calorimetric DSC and preliminary X-ray measurements on the fifth member - 5.OAOB - of the alkoxyazoxybenzene homologous series are presented. It has been found that 5.OAOB exhibits two mesophases: a nematic (N) and an "intermediate" crystalline phase (Cr I) just below it. From comparison of the DR and QNS studies one can conclude that in the N phase the molecule as a whole performs rotational diffusion around the long axis ($tau_{perpendicular}^{DR} \sim 150$ ps) and at the same time the two moieties perform faster independent reorientations around N - benzene rings bonds with $tau^{QNS} \sim 5$ ps. The Cr I phase is identified as a solid unaxial rotational phase in which fast molecular reorientations exist. It seems that the fast reorientations observed in the N phase to some extent survive to the Cr I phase. A model of molecular arrangements in the Cr I phase is proposed and it explains the reduction of the dielectric increment observed on passing from the N phase to this phase. (author).

6028 (INP–1317/PS) **Neutron scattering study of molecular motions in the naphthalene-tetracyanobenzene complex.** Czarniecka, K. (Uniwersytet Jagiellonski, Cracow (Poland). Inst. Chemii); Janik, J.M.; Janik, J.A.; Krawczyk, J.; Natkaniec, I.; Wasicki, J.; Kowal, R.; Pigon, K.; Otnes, K. Institute of Nuclear Physics, Cracow (Poland). Apr 1986. 20p. Order Number DE90610542. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Neutron diffraction measurements performed with the naphthalene- tetracyanobenzene complex showed the occurence of the phase transition at $\sim$ 70 K in thermal expansion of lattice parameters. Incoherent inelastic neutron scattering measurements showed many similarities between the phonon density of states of the complex on one hand and of the pure naphthalene on the other. There are also differences, which indicate a coupling between the external and the internal modes in the complex. The two positions between which these rotational jumps occur differ by $\sim$ 36 deg and a residence time is of the order of 8 ps at room temperature. (author).

6029 (INP–1323/PS) **Molecular reorientations in a substance with liquid-crystalline and plastic-crystalline phases.** Nguyen, Xuan Phuc. Institute of Nuclear Physics, Cracow (Poland). May 1986. 97p. Order Number DE90610544. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Results of dielectric relaxation (DR), quasielastic neutron scattering (QNS), far infrared absorption (FIR), proton magnetic resonance (PMR), differential scanning calorimetry (DSC) and preliminary X-ray diffraction measurements on the di-n-pentyloxyazoxybenzene (5.OAOB) are presented. The measurements carried out by all these methods showed that 5.OAOB exhibits a nontypical for liquid-crystalline materials phase diagram. It has two mesophases: a nematic (N) and an "intermediate" crystalline phase just below it. A complex interpretation of results obtained is given. All suggestions concerning the character of reorientational motions of the molecule as a whole as well as of its segments in mesomorphic phases are analyzed. From comparison of the DR and QNS studies one can conclude that in the N phase the molecule as a whole performs rotational diffusion around the long axis ($tau^{DR} \sim 100$ ps) and at the same time the two moieties perform faster independent reorientations around N - benzene rings bonds with$tau^{QNS} \sim 5$ ps. On the basis of various experimental data it is shown that the CrI phase is a plastic-crystalline phase for which the molecule and its segments perform fast stochastic unaxial reorientations. This is the first case where the existence of such a phase in liquid-crystalline materials has been experimentally confirmed. (author).

6030 (INP–1333/PS) **Dielectric relaxation spectra of liquid crystals in relation to molecular structure.** Wrobel, S. Institute of Nuclear Physics, Cracow (Poland). Jul 1986. 129p. Order Number DE90610545. Available from NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS.

The dielectric spectra obtained for some members of two homologous series, i.e. for di-alkoxyazoxybenzenes and penthyl-alkoxythiobenzoates, are discussed qualitatively on the basis of the Nordio-Rigatti-Segre diffusion model. It is additionally assumed that the molecular reorientations take place about the principal axes of the inertia tensor. The distribution of correlation times, which is strongly temperature dependent in the vicinity of the clearing point, is interpreted as being caused by fluctuations of the principal axes frame which are due to conformation changes inside the end chains. The Bauer equation is used to describe both principal molecular reorientations, i.e. the reorientations about the long and short axis, observed in liquid crystalline structure by means of dielectric relaxation methods. The energies and entropies of activation have been computed for both principal reorientations. The differences between the high frequency limit of the dielectric permittivity and the refractive index squared of liquid crystals are explained in terms of two librational motions of the molecules observed by other experimental techniques, viz. far infra-red, Raman and inelastic neutron scattering spectroscopies, and found in this work on the basis of dielectrically measured energy barriers. It has been shown qualitatively that intramolecular libratory motions greatly effect the high frequency dielectric spectrum. Finally, molecular motions in liquid crystals are divided into two types: coherent and incoherent. 127 refs., 56 figs., 17 tabs. (author).

6031 (IYaF–88-129) **On the radiative recombination of the electrons.** Mil'shtejn, A.I. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 7p. Order Number DE90608945. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

A process of the radiative recombination of the non-relativistic electron with a hydrogen-like ion is considered. A simple expression is derived for the total cross section of the process with the use of the analytic properties of the electron Green function in a Coulomb field. The dipole approximation is used.

6032 (JINR-R–6-88-580) **High resolution laser-atomic beam spectroscopy in GdI.** Gangrskij, Yu.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions); Zemlyanoj, S.G.; Kul'dzhanov, B.K. and others. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions. 1988. 10p. (In Russian). Order Number DE90610546. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

High resolution laser-atomic beam spectroscopy has been applied to investigate 15 optical transitions starting from the ground $4f^7 5d6s^2$ $a^9D_J{}^0$ multiplet of GdI. The transitions have been chosen in order to obtain more complete information about isotope shift and hyperfine splitting of the excited $4f^7 5d6s6p$ z^9F_J and z^9D_J multiplets. On the basis of the experimental results the hyperfine splitting constants of the excited levels and the J-dependence of the isotope shifts of all investigated multiplets have been deduced. 21 refs.; 2 figs.; 3 tabs.

6033 (LBL–27850) **Tenth Atomic Physics Program workshop: Program and abstracts.** Lawrence Berkeley Lab., CA (USA). Oct 1989. 140p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8911109–Summ.: 10. DOE Atomic Physics Program workshop, Berkeley, CA (USA), 8-9 Nov 1989). Order Number DE90003123. Available from NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.

This report contains short papers and abstracts on the following main topics: Ion-atom collision theory; laser physics; spectroscopy of atoms; spectroscopy of ions; and high velocity collisions.

6034 (LYCEN–88-28) **Two-photon transition intensities for Sm^{2+} in BaClF.** Kibler, M. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire); Gacon, J.C.; Marcerou, J.F.; Bouazaoui, M.; Jacquier, B. Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire. Jul 1988. 18p. (CONF-8806395–: 17. International colloquium on group theoretical methods in physics, Sainte-Adele, CA (USA), 27 Jun - 2 jul 1988). Order Number DE90727352. Available from NTIS (US Sales Only), PC A03/MF A01.

The two-photon transitions between the Stark levels of the $^7F_0$ and $^5D_2$ multiplets of the Sm^{2+} ion in BaClF are investigated both from an experimental and theoretical viewpoint. Direct two-photon excitation spectra of the $^5D_2$ fluorescence resulting from an optical excitation with an infrared laser beam are presented and the polarization dependence of the observed transitions is analyzed. These new data are interpreted along the lines of a simple model which originates in the second-order theory developed by Axe for two-photon processes in complex atoms. The extension of this theory to the case of rare-earth ions embedded in crystalline fields is carried out by taking advantage of symmetry adaptation techniques. It is shown that the resulting model (limited up to second-order terms) describes in a correct way the relative intensities of the two-photon transitions between the Stark levels of the $^7F_0$ and $^5D_2$ multiplets of Sm^{2+} in BaClF.

6035 (ORNL/FTR–3485) **[Multiconfigurational Dirac - Fock calculations of ionization potentials of unnilquadium and hafnium (2+)]: Foreign trip report, October 23–November 1, 1989.** Fricke, B. (Kassel Univ. (Gesamthochschule) (Germany, F.R.)). Oak Ridge National Lab., TN (USA). 27 Nov 1989. 3p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90003592. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The primary objective of the visit was the completion of the calculations, writing, and figures for a paper "Ionization Potentials and Radii of Atoms and Ions of Element 104 (Unnilquadium) and of Hafnium (2+) Derived from Multiconfiguration Dirac - Fock Calculations," E. Johnson, B. Fricke, O.L. Keller, C.W. Nestor, and T.C. Tucker. The paper is being submitted to J. Chem. Phys.

6036 (SAND–89-1118C) **Excitation lifetimes and excited-state forces in chemisorbed molecules.** Jennison, D.R.; Burns, A.R.; Stechel, E.B. Sandia National Labs., Albuquerque, NM (USA). [1989]. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8910276–2: 4. international workshop on desorption induced by electronic transitions, Gloggnitz (Austria), 2-4 Oct 1989). Order Number DE90002578. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Quantum-state populations and yields for the highest probability (neutral desorbate) channels are now available by laser resonance-ionization spectroscopy (RIS) [1,2], thus providing an unprecedented opportunity for theoretical progress in electron-stimulated desorption (ESD). In previous work [1-4], we reported a semi-quantitative explanation of the translational and internal energy distributions of NO° from Pt(111) based on a detailed microscopic model. More importantly, this work suggested several principles which appear general. After summarizing these, we present threshold data for the stimulated desorption of NO from (NO+O):Pt(111) and for the stimulated dissociation of NO_2:Pt(111), observed by the detection of the NO° product, $NO_2{}^*$ (a) → NO(g) + O(a). We review the assigned excitations in the NO:Pt(111) case and argue that coadsorbed oxygen greatly increases the excitation lifetime. For NO_2, consideration of the photoelectron spectrum, electronic structure, and excitation lifetimes allows us to assign the two dominant dissociation channels to specific one and two hole excitations. While the holes occupy non-bonding molecular orbitals (MOs), we find charge-transfer screening into a strongly antibonding MO. This screening, while far from complete, strongly influences the excitation lifetimes and forces, and affects the two channels differently. 12 refs., 3 figs.

6037 **X-ray spectroscopy of highly stripped very heavy ions.** Egan, P.O. (Lawrence Livermore National Lab., Livermore, CA); Chandler, G.A.; Dietrich, D.D.; Ziock, K.P.; Mokler, P.H.; Hoffmann, D.H.H. pp. 124 of Dynamic processes of highly charged ions. Kanai, Y.; Ohtani, S Institute of Plasma Physics, Nagoya, Japan (1987). DOE Contract W-7405-ENG-48. (CONF-860833–: 10. international conference on atomic physics, Tokyo (Japan), 25-29 Aug 1986).

By concentrating on the spectroscopy of very highly ionized neon-like system, the authors arrived at results which pose interesting problems for the theory of few electron systems, particularly the treatment of screening. These results provide one of the strongest tests of high field ($\alpha Z > 0.5$) QED.

6038 **Strong forward-backward asymmetries in electron emission from overlapping resonance states in fast C^{3+} on He collisions.** Yamazaki, Y. (Oak Ridge National Lab.); Miller, P.D.; Krause, H.F.; Pepmiller, P.L.; Datz, S.; Sellin, I.A.; Stolterfoht, N. pp. 124 of Dynamic processes of highly charged ions. Kanai, Y.;

Ohtani, S Institute of Plasma Physics, Nagoya, Japan (1987). (CONF-860833–: 10. international conference on atomic physics, Tokyo (Japan), 25-29 Aug 1986).

Autoionizing electrons from the configuration $1s^2$ 2pnl produced by transfer and excitation were measured for 2.5-5.0MeV C^{3+} + He-gas collision employing the method of zero-degree Auger spectroscopy. The electron analyzer was operated with an energy resolution of 300 meV(FWHM), which corresponds to the projectile rest frame energy resolution ~40meV.

6039 **Overview of electron-ion collisions.** Dunn, G. (Joint Institute for Lab. Astrophysics of the National Bureau of Standards and the Univ. of Colorado, Boulder, CO). pp. 124 of Dynamic processes of highly charged ions. Kanai, Y.; Ohtani, S Institute of Plasma Physics, Nagoya, Japan (1987). (CONF-860833–: 10. international conference on atomic physics, Tokyo (Japan), 25-29 Aug 1986).

The consequential roles of electron-ion collisions in a variety of plasmas - astrophysical, fusion, laser, etc. - have been responsible in substantial measure for a keen interest in these kinds of collisions in the past two decades. Elastic scattering, excitation, ionization, and recombination are all conceptually simple processes that have been studied and considered in electron-atom collisions for more than 70 years. Yet, these same processes, when pertaining to electron-ion collisions, continue to challenge the creative efforts of many to gain a detailed understanding. Technological breakthroughs leading to crossed beams experimental measurements on the various processes have led to impressive progress, and continued advances in technology have led to continued progress in electron-ion collision studies. For example, the introduction of ECR and EBIS ion sources have made it feasible to study a far broader range and variety of target ions, and only now is it possible to make colliding beams measurements with ions having $Q > 5$. Similarly, it is only in the past three years that the important process of dielectronic recombination has lent itself to cross section measurements.

6040 **Recombination processes in electron-ion collisions.** Hahn, Y. (Physics Dept., Univ. of Connecticut Storrs, CT). pp. 124 of Dynamic processes of highly charged ions. Kanai, Y.; Ohtani, S Institute of Plasma Physics, Nagoya, Japan (1987). (CONF-860833–: 10. international conference on atomic physics, Tokyo (Japan), 25-29 Aug 1986).

Magnetically confined fusion plasmas consist mainly of electrons and protons, with the electron kinetic energies in the 1-5 keV range and density of about 10^{13}-10^{14} cm^{-3}. Also present are many different species of impurity ions, with the nuclear core charges Z_c=2-60 and typical density of 10^8-10^{10} cm^{-3}. At such high temperatures (1 keV$\approx 10^7$K), ions with $Z_c \leq 30$ are nearly completely stripped of their electrons. On the other hand, the temperature near the container walls is lower and the ions there are presumably much less ionized. Therefore, to analyze the behavior of such plasmas, comprehensive and reliable atomic data on the important e-e, e-I and I-I collision processes are needed for many Z_c and Z=degree of ionization. The authors focus in this paper on the e-I capture process, with emphasis on high Z region. As is well-known, the e-I process is, together with the collisional excitation, one of the main radiation cooling mechanisms of high temperature plasmas.

6404 Fluid Physics

6041 (ETDE-IT–89-45) **Well-posedness of the magnetoplasmastatic problem with anisotropic stress tensor.** Lo Surdo, C. ENEA, Rome (Italy). [1987]. 11p. Order Number DE90724542. Available from NTIS (US Sales Only), PC A03/MF A01.

Rather than the inverse collision rate of the classical Chapman-Enskog approach, a most natural smallness parameter to be used in the asymptotic analysis of the Boltzmann-Maxwell system for a low-density, high magnetic strength magnetoplasma is the ion mass-to-charge ratio. By taking into account that the parallel electric field is virtually short-circuited at low density, one easily finds that the lowest-order ion distribution function, in general, depends on the parallel component of the 'peculiar' (i.e. relative to the average) velocity as well as its modulus. In the framework of a macroscopic theory, the parallel and perpendicular pressure components of the stress tenor cannot be computed from a distribution function; they must be (possibly) determined from macroscopic equations, which are to link them to the other relevant variables. It is generally agreed upon that the two-pressure magnetoplasmastatic problem is locally 'well posed' if the relevant PDE system admits, as a real characteristic conoid, only a disk perpendicular to the magnetic lines. The various cases of practical interest are briefly reviewed and the corresponding well-posedness condition is given for each of them.

6042 (IC–88/400) **Nucleation of vortices in superfluid helium-4.** Ahmad, M. International Centre for Theoretical Physics, Trieste (Italy). Dec 1988. 21p. Order Number DE90610675. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Nucleation of vortices and strings is studied in superfluid helium in the context of phase transitions in this system. It is shown that the formation of these structures depends on the homotopy groups of the manifold of degenerate condensed states. The subsequent evolution of these structures is investigated and then impact on superfluid nature of this system is analyzed. The cross section for the scattering of quasi particles is estimated. This is exploited to find the effect of scatterings on the dynamics of shrinking vortex. (author). 17 refs.

6043 (IC–88/401) **Goldstone excitation and symmetry breaking mechanism in superfluid - He^4.** Ahmad, M. (International Centre for Theoretical Physics, Trieste (Italy)); Hanna, M.H.; Tikoo, S.K.; Raina, T.K. International Centre for Theoretical Physics, Trieste (Italy). Dec 1988. 14p. Order Number DE90610676. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The form of Goldstone excitation in superfluid - He^4 is envisaged by the formalism of scaling transformation. This is achieved within the framework of symmetry breaking mechanism which is akin to that of the relativistic quantum field theory. (author). 27 refs.

6044 (IC–88/402) **Coherent state in the roton region of superfluid helium-4.** Ahmad, M. (International Centre for Theoretical Physics, Trieste (Italy)); Hanna, M.H.; Tikoo, S.K.; Raina, T.K. International Centre for Theoretical Physics, Trieste (Italy). Dec 1988. 13p. Order Number DE90610677. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Coherent states in the roton region of superfluid He^4 are studied with a view to determine the transition probability from phonon to roton states. These states are formed such that they are found to be identical to those of the angular momentum states. (author). 21 refs.

6045 (K/QT–279) **Comments on compressible flow through butterfly valves.** Blakenship, J.G. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). Oak Ridge Gaseous Diffusion Plant, TN (USA). [1989]. 5p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC05-84OT21400. (CONF-891208–10: Winter annual meeting of the American Society of Mechanical Engineers, San Francisco, CA (USA), 10-15 Dec 1989). Order Number DE89015730. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

In the flow analysis of process piping systems, it is desirable to treat control valves in the same way as elbow, reducers, expansions, and other pressure loss elements. In a recently reported research program, the compressible flow characteristics of butterfly valves were investigated. Fisher Controls International, Inc., manufacturer of a wide range of control valves, publishes coefficients that can be used to calculate flow characteristics for the full range of valve movement. This paper describes the use of the manufacturer's data to calculate flow parameters as reported by the researchers who investigated compressible flow through butterfly valves. The manufacturer's data produced consistent results and can be used to predict choked flow and the pressure loss for unchoked flow. 4 refs., 6 figs., 1 tab.

6046 (LA-UR–89-3984) **A brief description of lattice gas models for multiphase flows and magnetohydrodynamics.** Chen, H. (Los Alamos National Lab., NM (USA)); Chen, S.; Doolen, G.D.; Matthaeus, W.H. Los Alamos National Lab., NM (USA). [1989]. 16p. Sponsored by U.S. DOE Management & Administration; National Aeronautics and Space Administration. DOE Contract W-7405-ENG-36. NAGW-1648. (CONF-8906239–2: Santa Fe Institute summer school on complex systems, Santa Fe, NM (USA), 5-30 Jun 1989). Order Number DE90003653. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Lattice gas models for multiphase fluids and for magnetohydrodynamic fluids are briefly described. 16 refs.

6047 (SAND–89-2604C) **Comments on ER [electrorheological] fluid rheology.** Kraynik, A.M. Sandia National Labs., Albuquerque, NM (USA). [1989]. 10p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-8908183–1: 2. international conference on electrorheological fluids, Raleigh, NC (USA), 7-9 Aug 1989). Order Number DE90002892. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The label electrorheological (ER) fluid reflects the salient feature of these materials that continues to attract the attention of scientists and technologists alike. This is the ability to induce significant changes in rheology through an applied electric field. This electrically induced transformation of a fluid-like suspension of nonconducting particles and liquid, to a solid-like gel with a yield stress and corresponding high viscosity, is as useful as it is striking. The ability to characterize and understand this so-called Winslow effect is fundamental to successful applications. The current interest in ER fluid development provides strong motivation to rheologists. Our purpose here is to discuss briefly some principles of rheology that apply to ER fluids; they range from well-established and familiar to somewhat subtle. We will focus on the measurement of viscosity and yield stress. 8 refs., 2 figs.

6048 (UCRL–100585) **Testing and performance of a high-gain flux-compression generator.** Pincosy, P.A. (Lawrence Livermore National Lab., CA (USA)); Cutting, J.L.; Chase, J.B. Lawrence Livermore National Lab., CA (USA). 30 Aug 1989. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890710–23: 5. international conference on megagauss magnetic field generation and related topics, Novosibirsk (USSR), 3-7 Jul 1989). Order Number DE90002808. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

A workable high-grain, high-explosive helical magnetic-flux- compression generator (HEG) must be fabricated with the required tolerances, and the expanding high explosive and armature must be centered and radically uniform. We tested the tolerance and expansion issues with a mini-HEG having a constant density of stator turns that would simulate the first part of a full-scale generator, which also has a constant turns density. We scaled to the mini size on the basis of parameter changes that respected the tolerance requirements for alignment and thickness of the armature wall. We tested a precision initiator separately on the high explosive to be used in the armature. Uniformity and smoothness of the armature's expansion were tested separately. We tested the mini-HEG for turn-skipping and to evaluate the predictions of our circuit analysis simulation program, CIRC. We also measured the turn-to-turn voltage stress. 4 refs., 6 figs.

6450 High Energy Physics

Refer also to citation(s) 5736

6451 Particle Interactions and Properties - Experimental

Refer also to citation(s) 5780, 5988, 6108, 6109

6049 (ANL-HEP-CP–89-110) **Current results from CDF on W, Z, and top.** Wagner, R.G. Argonne National Lab., IL (USA). [1989]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-8904226–13: 12. international workshop on weak interactions and neutrinos, Ginosar (Israel), 9-14 Apr 1989). Order Number DE90003825. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Results based on data collected by the Collider Detector at Fermilab (CDF) during the Tevatron Collider run now in progress are presented. The results cover analyses of $W \rightarrow e\nu_e$ and $Z \rightarrow e^+e^-$, $\mu^+\mu^-$ event candidates, and discuss the status of the CDF top quark search. Preliminary results from studies of events containing a high E_T electron and muon or a high E_T electron plus ≥ 2 jets indicate that it is unlikely that the top quark mass is in the range $30 \leq M_{top} \leq 60$ GeV/c^2 assuming Standard Model charged current decay. 4 refs., 13 figs.

6050 (ANL-HEP-CP–89-125) **Physics landscape-fixed target energies.** Berger, E.L. Argonne National Lab., IL (USA). Oct 1989. 42p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. (CONF-890872–4: Workshop on physics at Fermilab in the 1990's, Breckenridge, CO (USA), 15-24 Aug 1989). Order Number DE90003195. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

An introductory review is presented of physics issues and opportunities at Fermilab fixed-target energies. Included are discussions of precision electroweak studies; deep inelastic lepton scattering; heavy quark production, spectroscopy, and decays; perturbative QCD; prompt photon production; massive lepton production; and spin dependence. 79 refs., 7 figs.

6051 (CONF-890520–4) **BOREX: Solar neutrino experiment via weak neutral and charged currents in boron-11.** Kovacs, T. (AT and T Bell Labs., Murray Hill, NJ (USA)); Mitchell, J.W.; Raghavan, P.; Raghavan, R.S.; Freedman, S.J.; Kay, J.; Lane, C.E.; Steinberg, R.I.; Cattadori, C.; Donati, A.; Pakvasa, S.; Deutsch, M.; Rothschild, P.; Arpasella, C.; Bellini, G.; BArgonne National Lab., IL (USA). [1989]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From International conference: inside the sun; Versailles (France); 22-26 May 1989. Order Number DE90003790. Available from NTIS, PC A02/MF A01; OSTI; INIS.

Borex, and experiment to observe solar neutrinos using boron loaded liquid scintillation techniques, is being developed for operation at the Gran Sasso underground laboratory. It aims to observe the spectrum of electron type ^{8}B solar neutrinos via charged current inverse β-decay of ^{11}B and the total flux solar neutrinos regardless of flavor by excitation of ^{11}B via the weak neutral current. 14 refs.

6052 (DOE/ER/10667–T5) **Experimental particle physics at the University of Pittsburgh: Progress report.** Cleland, W.E.; Coon, D.D.; Engels, E. Jr.; Shepard, P.; Thompson, J.A. Pittsburgh Univ., PA (USA). Dept. of Physics and Astronomy. Dec 1989. 171p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-80ER10667. Order Number DE90003536. Available from NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.

This report discusses the following topics: HELIOS/1 and HELIOS/2; direct photon production at the Tevatron; search for fractional charge particles in semiconductors; and SSC ionization calorimetry studies.

6053 (DOE/ER/40224–96) **Understanding QCD [Quantum Chromodynamics] at colliders.** Olness, F.I. Oregon Univ., Eugene, OR (USA). Inst. of Theoretical Science. Mar 1989. 12p. Sponsored by U.S. DOE Energy Research; National Science Foundation. DOE Contract FG06-85ER40224. (CONF-8902151–1: 1989 Lake Louise winter institute: frontiers in physics–from colliders to cosmology, Lake Louise (Canada), 19-25 Feb 1989; OITS–405). Order Number DE90003330. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

We examine Drell-Yan μ-pair production and heavy quark pair production, and demonstrate how to implement precise comparisons between the theoretical predictions of QCD and the experimental observables. Specifically, we have dealt with theoretical uncertainties arising from higher order corrections, unknown small-χ behavior, and the unknown gluon distribution. We indicate how the above processes can provide discriminating tests of the theory in the kinematic regimes which will soon be investigated by the Tevatron I and HERA facilities. 8 refs., 6 figs.

6054 (FNAL/C–89/216) **Fluxes and background from $\Sigma^+ \rightarrow$ polarized proton at Fermilab.** Carey, D.C. Fermi National Accelerator Lab., Batavia, IL (USA). Oct 1989. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-8909270–1: 3. workshop on high energy spin physics, Protvino (USSR), 5-7 Sep 1989). Order Number DE90003344. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The decay of a Σ^+ hyperon produces a proton whose polarization is correlated with its momentum in the hyperon center of mass. The positive charge of the hyperon allows momentum selection both on it and on the proton. A beam of longitudinally polarized protons can be produced, by backward decays in the center of mass. The Λ hyperon being neutral, does not allow momentum selection. Transversely polarized protons, produced by the decay of Λ particles must

be identified by tagging hodoscopes at an intermediate focus in the proton beam line. The use of Σ^+ hyperons to produce polarized protons was first suggested by Rafil Rzaev, a visitor to Fermilab from Serpukhov. He was primarily concerned with the existing 200 GeV polarized beam in the Fermilab meson area. Since then interest has been shown in polarized protons by other experimental collaborations. These experiments are at the ends of beam lines in existing tunnels. These tunnels are curved an are well suited to a Σ^+ produced polarized proton beam which has a net band. The expected fluxes and backgrounds for the beam are discussed here. 2 refs.

6055 (SLAC-PUB–5114) **Recent Ψ' results from Mark III.** Mir, R. (Washington Univ., Seattle, WA (USA)). Stanford Linear Accelerator Center, Menlo Park, CA (USA). Oct 1989. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (UWSEA-PUB–89-20;CONF-890903–4: International Europhysics conference on high-energy physics, Madrid (Spain), 7-14 Sep 1989). Order Number DE90004420. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Results on Ψ' decays from Mark III are presented. With a data sample of 240,000 ψ' events, we measure $\psi' \to \pi^+\pi^-\psi$, $\psi' \to \eta\psi$, $\psi' \to \gamma\chi_c$, $\psi' \to \gamma 4\pi^\pm$, $\psi' \to \gamma 6\pi^\pm$, and perform a search for $\psi' \to \rho\pi$. Implications of our measurements are discussed. 14 refs., 6 figs., 1 tab.

6056 (SLAC-PUB–5139) **Production of the $f_0(975)$ meson in J/Ψ decays.** Lockman, W.S. Stanford Linear Accelerator Center, Menlo Park, CA (USA). Nov 1989. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00515. (SCIPP–89/51;CONF-8909221–4: HADRON '89: 3rd international conference on hadron spectroscopy, Ajaccio (France), 23-27 Sep 1989). Order Number DE90004433. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Preliminary results on the production and decay of the $f_0(975)$ meson in the processes $J/\Psi \to \phi\pi^+\pi^-$, $J/\Psi \to \phi\pi^0\pi^0$, $J/\Psi \to \phi K^+K^-$, and $J/\Psi \to \omega\pi^+\pi^-$ are reported on. The data sample, corresponding to 5.8×10^6 produced J/Ψ's, were collected with the MARK-III detector at SPEAR. In a coupled- channel fit to the invariant mass distribution of the $\pi^+\pi^-$ system opposite the ϕ, the $f_0(975)$ product branching ratios, resonance parameters and couplings to K^+K^- and $\pi^+\pi^-$ are extracted. An upper limit on $f_0(975)$ production in conjunction with an ω is presented. 15 refs., 4 figs., 4 tabs.

6452 Particle Interactions and Properties - Theoretical

Refer also to citation(s) 5998

6057 (BONN-IR–88-34) **A study on the detection and on the mass determination of top quarks in the energy range of LEP I.** Simon, A. Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet. Jul 1988. 88p. (In German). Available from Available from Bonn Univ. (Germany, F.R.). Physikalisches Inst.

Different signatures for the detection of top-quark production at CMS energies of LEP I are studied in this report. It is shown that high energetic isolated leptons give the best signature for top production. Even for possible top masses up to the maximum beam energy of LEP I a significant top signal can be detected. Methods of top mass determination are investigated with respect to their needs of integrated luminosity. On the Z^0-resonance the best determination of the top mass can be achieved by a reconstruction of the invariant mass. If the top mass is greater than $m_{Z0}/2$, a binary scan technique, using again isolated leptons as a signature, gives the best mass determination. (orig.).

6058 (DOE/ER/40224–92) **Rare semileptonic and radiative decays of beautiful mesons.** Deshpande, N.G.; Trampetic, J. Oregon Univ., Eugene, OR (USA). Inst. of Theoretical Science. Nov 1988. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-85ER40224. (CONF-8811289–1: Rare decay symposium, Vancouver (Canada), 30 Nov - 3 dec 1988; OITS–401). Order Number DE90003329. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Higher order electroweak effects can be effectively tested in B decays involving the short distance flavor changing (b→s) transition. We estimate the exclusive rates involving a virtual photon like $B \to K\ell^+\ell^-$ and real photon like $B \to K^*\gamma$ using relativistic constituent quark model to calculate the different form factors that include recoil effects. The effects of QCD enhancement, and the resulting $e-\mu$ rate difference, as well as the long distance effects and the effect of the fourth generation in enhancing the rates are also discussed. 7 refs., 4 figs.

6059 (DOE/ER/40427–17-N9) **$^3P_0$ and $^3S_1$ contributions to $\bar{p}p \to \bar{\Lambda}\Lambda$.** Alberg, M.A. (Seattle Univ., WA (USA). Dept. of Physics); Henley, E.M.; Wilets,; Kunz, P.D. Washington Univ., Seattle, WA (USA). Dept. of Physics. [1989]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-88ER40427. (CONF-8907127–5: 12. few body conference: few body problems in physics, Vancouver (Canada), 2-8 Jul 1989). Order Number DE90003334. Available from NTIS, PC A02/MF A01; OSTI; INIS.

We have proposed a quark model for $\bar{N}N$ annihilation which consists of a linear superposition of the so-called $^3P_0$ (scalar) and $^3S_1$ (vector) models. We have argued that this approach is more consistent with QCD and the analogous NN system than the use of either model alone. Recent precise measurements of the $\bar{p}p \to \bar{\Lambda}\Lambda$ reaction by the PS185 collaboration at LEAR provide a test of this model. Ad advantage of strange baryon production is the polarization information that can be obtained due to their weak decays. Spin effects are known to be more sensitive to details of the reaction mechanism. In this paper we present the results of distorted wave calculation for the production of $\bar{\Lambda}\Lambda$; distortion effects due to real and imaginary (absorptive) potentials in both initial and final states are included. Our results at p_{lab} = 1.5075 GeV/c and p_{lab} = 1.564 GeV/c show that the best fits to the differential cross section and polarization data are obtained with an interference between scalar and vector terms. The sensitivity of our results to the parameters of the $\bar{\Lambda}\Lambda$ potential indicates that this reaction may be used to provide information about the hyperon-antihyperon interaction, about which very little is known. 10 refs., 4 figs.

6060 (IC–89/148) **Reflection, transmission and spin rotation of Dirac neutrinos in magnetic fields.** Barut, A.O.; Bozic, M. International Centre for Theoretical Physics, Trieste (Italy). Jun 1989. 29p. Order Number DE90609236. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Reflection and transmission coefficients of Dirac neutrinos with a magnetic moment through magnetic fields are calculated. The motion is in three dimensions. We find that one spin component can undergo a total reflection, but the other not, this effect being most pronounced at neutrino energies equal to the magnetic energy μB. We also determine the spin rotation angle (equivalently the helicity rotation angle). (author). 9 refs, 4 figs.

6061 (IC–89/293) **On the photoproduction of gravitons on spinor particles.** Hoang Ngoc Long (International Centre for Theoretical Physics, Trieste (Italy)); Le Khac Huong. International Centre for Theoretical Physics, Trieste (Italy). Sep 1989. 7p. Order Number DE90610683. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The photoproduction of the gravitons on the spinor particles in the gravitational theory is considered. In contradiction with the previous result we show that, in the low energy limit, the photon intermediate states give a main contribution in the cross-section and, in both low and high energy limits, the probability of the graviton creation is higher in the direction of the photon motion. (author). 13 refs.

6062 (IPNO-TH–89-19) **Lyapunov stability and Poisson structure of the thermal TDHF and RPA equations.** Veneroni, M. (Paris-11 Univ., 91 - Orsay (FR). Inst. de Physique Nucleaire); Balian, R. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1989. 45p. Order Number DE90727321. Available from NTIS (US Sales Only), PC A03/MF A01.

The thermal TDHF equation is analyzed in the Liouville representation of quantum mechanics, where the matrix elements of the single-particle (s.p.) density rho behave as classical dynamical variables. By introducing the Lie-Poisson bracket associated with the unitary group of the s.p. Hilbert space, we show that TDHF has a hamiltonian, but non-canonical, classical form. Within this Poisson structure, either the s.p. energy or the s.p. grand potential Ω(rho) act as a Hamilton function. The Lyapunov stability of both the TDHF

and RPA equations around a HF state then follows, since the HF approximation for thermal equilibrium is determined by minimizing Ω(rho). The RPA matrix in the Liouville space is expressed as the product of the Poisson tensor with the HF stability matrix, interpreted as a metric tensor generated by the entropy. This factorization displays the roles of the energy and entropy terms arising from Ω(rho) in the RPA dynamics, and it helps to construct the RPA modes. Several extensions are considered.

6063 (IPNO-TH-89-23) **Fermions at high temperature.** Gatoff, G. (Paris-11 Univ., 91 - Orsay (FR). Inst. de Physique Nucleaire); Kapusta, J. Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire. 1989. 29p. Order Number DE90727322. Available from NTIS (US Sales Only), PC A03/MF A01.

We calculate the self-energy of massless fermions interacting with massless bosons at high temperature by summing the set of ring diagrams. This leads to an effective one loop equation. We further approximate the boson self-energy by a temperature-dependent mass-squared which is of order $(gT)^2$. At low momenta, $p<g^2T$, the fermion dispersion relation is $\omega = 1/3p$, whereas for high momenta, $p>gT$, it is $\omega = p$. In the intermediate region, $g^2<p<gT$, the fermion oscillations are overdamped and do not propagate. We speculate that this may be due to spatial inhomogeneities caused by the formation of resonant or coherent states of bosons and fermions, which have a characteristic size of $1/gT$ and a characteristic separation of $1/g^2T$.

6064 (JINR-R-2-88-657) **Low-energy predictions of modern chiral lagrangians based on quark dynamics: Lectures for young scientists.** Bel'kov, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij); Pervushin, V.N.; Ehbert, D. Joint Inst. for Nuclear Research, Dubna (USSR). 1988. 59p. (In Russian). Order Number DE90610685. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Appproach to description of low-energy meson interactions using the method of chiral Lagrangians(CL) is suggested. Experimental data for considered low-energy meson processes are presented. The most perspective experiments on testing QCD predictions in low-energy limit are discussed. Main theoretical ideas and results of nonlinear CL construction as well as phenomenological consequencies of the theory are discussed taking analysis of data on $\pi\pi$-, πK-interactions, radiation K_{α_4}-decays, K -> $2\pi\gamma$, K^+ -> $\pi^+\gamma\gamma$, hadronic decays eta' -> eta$^{2\pi}$ as an example. Chiral anomalies in studied processes are considered. The conducted analysis of low-energy meson processes showed that modern CL obtained from quark models including QCD corresponded with available experimental data. Calculations showed that study of meson decays was more effective for testing theory as compareed to measuring parameters of meson-meson scattering. Consideration of the role of chiral anomalies in describing radiative decays of kaons shows that detection of the effects of CP-breaking in K^{+-} -> π^{+-} π^0 γ decays is impossible within the limits of experiment accurancies. 49 refs.; 4 tabs.

6065 (LAL-89-01) **First order QED and QCD radiative corrections to Higgs decay into massive fermions.** Janot, P. Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire. Feb 1989. 12p. Order Number DE90727323. Available from NTIS (US Sales Only), PC A03/MF A01.

The decay rates of the standard neutral Higgs boson into massive fermions (H^0 -> fantif) are calculated, including first order QED and QCD radiative corrections. Analytical expressions for the differential partial decay widths are given for both virtual corrections and Bremsstrahlung. The results of the integrations are presented. The processes H^0 -> fantif (γ or g) and γ^* -> fantif (γ or g) are compared, and the most important differences are outlined.

6066 (LBL-27047) **CP violation at the Z peak.** Bernreuther, W. Lawrence Berkeley Lab., CA (USA). 1 Jun 1989. 9p. Sponsored by German Research Partnership (Deutsche Forschungsgemeinschaft - DFG); U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8904293--1: CERN Working Group on rare Z boson decays, Geneva (Switzerland), 10-14 Apr 1989). Order Number DE90000553. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Some possibilities for searches of CP-nonconservation in decays of the Z boson produced in e^+e^- collisions are briefly reviewed. 18 refs.

6067 (OUP-89-02) **Lambda/kaon relative production in anti p + nucleus reactions in terms of a quark recombination diagram.** Haatuft, A. (Bergen Univ. (Norway). Dept. of Physics); Halsteinslid, A.; Breivik, F.O. and others; LEAR Collaboration. Oslo Univ. (Norway). Fysisk Inst. Mar 1989. 9p. Order Number DE90609240. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

CERN project PS-179.

The ratio R=N(Λ^o)/N(K^o S) between the number N(Λ^o) of Λ^o's and the number N(K^o s) of the short-lived neutral kaons produced in the reaction anti p + nucleus reactions at low energy has in previous papers been discussed in terms of the fireball model of Cugnon and Vandermeulen and in terms of the reaction anti KN -> $\Lambda^o\pi$, where the anti K has been produced in the primary reaction anti pp -> anti KK + X. In this note the ratio R is discussed in terms of the quark model. The results indicate that quark effects may be important for the reaction studied, even if the energy is low. The discussion is based on the assumption that diagrams with connected quark-lines from initial to final state are suppressed, and that valence quarks survive to the final state. This assumption is supported by the results of exclusive anti pp-reactions at low energy, which shows that final states with more than two pions or kaons are more likely than final states with two mesons only, even if low multiplicity is favoured by phase space.

6068 (OUP-89-12) **Effective interactions through third order for mass-18 nuclei with the Paris potential.** Hjort-Jensen, M.; Osnes, E. Oslo Univ. (Norway). Fysisk Inst. Jun 1989. 10p. Order Number DE90609241. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The behaviour of the effective interaction in the (sd)-shell through third order for mass-18 has been studied with the meson-theoretical Paris potential. All JT states were considered. The results are compared with those obtained with the G-matrix of Kuo and Brown, based on the phenomenological Hamada-Johnston potential. The excitation spectra obtained with both these potentials are rather similar. The Paris potential gives, however, a better fit through third order, whereas it produces more binding for low-lying states through second order. Still, evidence for non-convergent behavior is found in T=0 states for the Paris potential. 21 refs.

6069 (OUP-89-13) **Number-conserving sets and effective interactions through third order for mass-18 with the Bonn-Juelich potential.** Hjort-Jensen, M.; Osnes, E. Oslo Univ. (Norway). Fysisk Inst. Jun 1989. 16p. Order Number DE90609242. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The two third order number-conserving sets of diagrams and the effective interaction through third order for ^{18}O and ^{18}F have been calculated with the meson-theoretical Bonn-Juelich potential. All JT states of the $(sd)^2$ configuration have been considered. The relative cancellation among the number-conserving sets is similar to that obtained with the meson-theoretical Paris potential, yielding therefore a somewhat improved cancellation compared to phenomenological potentials. The calculated spectra are compared to those obtained with the phenomenological Reid soft-core potential. The latter shows the best agreement with experiment, whereas the Bonn-Juelich results agree poorly. Both potentials do however exhibit non-convergent behavior for certain low-lying ^{18}F states. Some implications are discussed. 24 refs.

6070 (OUP-89-15) **CP-violation - a window to new physics.** Eeg, J.O. Oslo Univ. (Norway). Fysisk Inst. Aug 1989. 10p. Order Number DE90609237. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Violation of combined charge and parity symmetry in strangeness changing K-meson decays is shortly reviewed. The $\Delta S=2$ K^o reversible anti K^o transition and $\Delta S=1$ processes K -> 2π are described in the quark language. It is pointed out that even if the standard SU(3) X SU(2) X U(1) theory gives an excellent description of the present particle physics, precise measurements of exotic phenomena like CP-violation might reveal whether there is new physics beyond the standard theory.

6071 (OUP–89-17) **Exclusive semileptonic B decays in the bag model.** Lie-Svendsen, Oe. Oslo Univ. (Norway). Fysisk Inst. Sep 1989. 15p. Order Number DE90610679. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Using a recoil corrected version of the MIT bag model, the author has computed the relevant form factors and decay rates for the exclusive semileptonic decays B->De anti ν e and B->D*e anti ν e. The results are similar to other quark model calculations, but it is shown that the D* mode is suppressed due to the influence of the spectator quark. The D*'s produced are almost unpolarized in this model. 24 refs.

6072 (RAL–89-051) **Heavy flavours in high energy e^+e^- annihilation.** Marshall, R. Rutherford Appleton Lab., Chilton (UK). Jun 1989. 16p. Order Number DE90609243. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

To be published in Journal of Physics G.

This paper reviews the quantum flavour dynamic and fragmentation properties of the heavy leptons and quarks and for the purpose of this report, the heavy flavours are taken to be the tau lepton and the c and b quarks. The production of tau^+tau^- and the electroweak properties of the tau are first discussed and then the tau charged current decay properties are considered and compared with those of the μ. The role of tau decays in the understanding of Quantum Chromo Dynamics is also considered. The production of heavy quark pairs is considered in the framework of the standard model and the weak neutral current charges of the quarks are presented from a global analysis of all existing data. The weak decays of c and b are discussed and the measurements of lifetimes and leptonic widths considered as input parameters to the eventual determination of the quark weak mixing matrix elements. Finally the fragmentation of c and b quarks is discussed and the various measurements presented. (author).

6073 (RAL–89-066) **K_L->$\pi^0e^+e^-$ in the standard model with a heavy top quark.** Flynn, J.M. Rutherford Appleton Lab., Chilton (UK). Jul 1989. 4p. Order Number DE90609244. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

We consider the theoretical predictions for the decay K^L -> $\pi^0e^+e^-$ in the standard model with a heavy top quark. Theoretically, the decay is interesting because we may be able to see a CP violating amplitude. However, there are three competing pathways for the decay. The leading electromagnetic process is through a $\pi^0\gamma^-$ intermediate state in a total angular momentum zero, and hence CP even, configuration. Since K_L is mostly CP odd, $K_L \sim K_1 + \epsilon K_2$, this one-photon process violates CP either directly, when the CP odd component decays, or indirectly through the decay of the small CP even component. The higher order electromagnetic process, K_L -> $\pi^0\gamma\gamma$ -> $\pi^0e^+e^-$, can be competitive in rate, since it can proceed without CP violation. The theoretical estimates of these three competing mechanisms are discussed. We will show all three contributions could give rise to a branching ratio for K_L -> $\pi^0e^+e^-$ which is at most of order 10^{-11}. (author).

6074 **Critical reanalysis of CP asymmetries in B^0 decays to CP eigenstates.** Grinstein, B. (Fermi National Accelerator Lab., Batavia, IL (USA)). *Physics Letters [Section] B (Netherlands)*, 229(3): 280-284 (12 Oct 1989).

The time integrated CP asymmetry in the decay of a neutral B meson to a CP eigenstate has been claimed to be free of uncertainties arising from hadronic matrix elements (modulo the mixing parameter $\Delta m/\Gamma$). That is, it is a direct measure of KM angles. We scrutinize this claim, and question its generality. To this end we compute the effective hamiltonian for $\Delta B=1$, charm and up conserving processes, in the leading logarithmic approximation. Enhancement of hadronic matrix elements of 'penguin' operators could easily invalidate the claim. (orig.).

6453 Particle Invariance Principles and Symmetries

Refer also to citation(s) 6070

6075 (BONN-IR–89-24) **Conformal invariance of the spin-1 XXZ chain and the operator content of supersymmetric models with central charge c < 3/2.** Baranowski, D. Bonn Univ. (Germany, F.R.). Physikalisches Inst.; Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet. Jun 1989. 35p. (In German). Available from Available from Bonn Univ. (Germany, F.R.). Physikalisches Inst.

The operator content of the spin-1 XXZ chain is given for all possible boundary conditions. It is studied how this chain is related to the conformal invariance of supersymmetric models with central charge c < 3/2. (orig.).

6076 (DOE/ER/40427–16-N9) **Charge symmetry breaking: An overview.** Miller, G.A. Washington Univ., Seattle, WA (USA). Inst. for Nuclear Theory. 1989. 10p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-88ER40427. (CONF-8906235–2: Symposium on spin and symmetries, Vancouver (Canada), 30 Jun - 2 jul 1989). Order Number DE90003333. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Diverse aspects of charge symmetry breaking (CSB) are reviewed. I argue that the mass difference between up and down quarks is responsible for all observed nonelectromagnetic CSB. 36 refs., 1 tab.

6454 Field Theory

Refer also to citation(s) 5994, 6260, 6263

6077 (DOE/ER/03130–433) **Cosmic strings and baryon decay catalysis.** Gregory, R. (Fermi National Accelerator Lab., Batavia, IL (USA)); Perkins, W.B.; Davis, A.C.; Brandenberger, R.H. Fermi National Accelerator Lab., Batavia, IL (USA). Sep 1989. 25p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (FNAL/C–89/215-A;CONF-8907i71–2: Symposium on the formation and evolution of cosmic strings, Cambridge (UK), 2-7 Jul 1989). Order Number DE90003129. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Cosmic strings, like monopoles, can catalyze proton decay. For integer charged fermions, the cross section for catalysis is not amplified, unlike in the case of monopoles. We review the catalysis processes both in the free quark and skyrmion pictures and discuss the implications for baryogenesis. We present a computation of the cross section for monopole catalyzed skyrmion decay using classical physics. We also discuss some effects which can screen catalysis processes. 32 refs., 1 fig.

6078 (DOE/ER/40224–105) **Extension of the gauge sector beyond the standard model.** Deshpande, N.G. Oregon Univ., Eugene, OR (USA). Inst. of Theoretical Science. May 1989. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG06-85ER40224. (OITS–414;CONF-8811175–6: Beyond the standard model, Ames, IA (USA), 18-22 Nov 1988). Order Number DE90003352. Available from NTIS, PC A03/MF A01; OSTI; INIS.

We discuss different extensions of the standard model that permit a richer gauge sector. Models based on $SU(2)_L \times SU(2)_R \times U(1)$ gauge group, and those that follow from E_6 are discussed in detail. Remarks about horizontal gauge extensions are also made. 5 refs., 5 figs., 1 tab.

6079 (ENEA-RT-TIB–88-49) **Matrix representation of the evolution operator for the SU(3) dynamics.** Dattoli, G.; Torre, A. ENEA, Frascati (Italy). Centro Ricerche Energia. May 1989. 19p. Order Number DE90724603. Available from NTIS (US Sales Only), PC A03/MF A01.

Submitted to Journal of Mathematical Physics.

Relative to problems in optics (i.e. the interaction of a two-level system with a radiation field) this paper studies the evolution of quantum states ruled by Hamiltonian operators, linear in the SU(3) generators. The study evolves within the framework of a method, which combines the Wei-Norman ordering technique with the geometrical representation of the SU(3) generators. As a major result, the Rabi matrix specifying the motion of the SU(3) Bloch vector is obtained even for a time-dependent Hamiltonian.

6080 (FNAL/C–89/220) **Designing machines for lattice physics and algorithm investigation.** Fischler, M.; Atac, R.; Cook, A.; Deppe, J.; Eichten, E.; Gaines, I.; Gao, M.; Hockney, G.; Husby, D.; Kronfeld, A.; Mackenzie, P.; Nash, T.; Pham, T.; Zmuda, T. Fermi National Accelerator Lab., Batavia, IL (USA). Oct 1989. 5p.

Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03000. (CONF-8909249–2: Lattice '89 international workshop, Capri (Italy), Sep 1989). Order Number DE90003543. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Special-purpose computers are appropriate tools for the study of lattice gauge theory. While these machines deliver considerable processing power, it is also important to be able to program complex physics ideas and investigate algorithms on them. We examine features that facilitate coding of physics problems, and flexibility in algorithms. Appropriate balances among power, memory, communications and I/O capabilities are presented. 10 refs.

6081 (IC–89/139) **Long-distance asymptotics of temperature correlators of the impenetrable Bose gas.** Its, A.R. (Leningradskij Gosudarstvennyj Univ., Leningrad (USSR)); Izergin, A.G.; Korepin, V.E. International Centre for Theoretical Physics, Trieste (Italy). Jun 1989. 22p. Order Number DE90610496. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The inverse scattering method is applied to the integrable nonlinear system describing temperature correlators of the impenetrable bosons in one space dimension. The corresponding matrix Riemann problems are constructed for two-point as well as for multi-point correlators. Long-distance asymptotics of two-point correlators is calculated. (author). 8 refs.

6082 (IC–89/161) **Solutions of the classical SU(2) Yang-Mills theory in 2+1 dimensions with the Chern-Simons term: Ansatz building.** Teh, R. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 10p. Order Number DE90610497. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Here I would like to show a general way of writing the gauge potentials $A_\mu{}^\alpha$ for which the SU(2) Yang-Mills equations of motion can be simplified and become solvable. A number of exact solutions can be obtained from these simplified equations of motion. (author). 14 refs.

6083 (IC–89/174) **A generalised Virasoro algebra for the Type IIA superstring.** Pope, C.N. (Texas A and M Univ., College Station, TX (USA). Center for Theoretical Physics); Sezgin, E. International Centre for Theoretical Physics, Trieste (Italy). Sep 1989. 13p. (CTP-TAMU–56/89). Order Number DE90610498. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

We extend Siegel's generalised Virasoro algebra for Type I superstring to Type IIA superstrings. Since the Type IIA superstring can be obtained from the eleven-dimensional supermembrane by dimensional reduction, it is natural to seek a Type IIA Virasoro algebra that can be derived from one for the supermembrane. This leads to an algebra containing an infinite number of generators, including as a subset those of the direct sum of a left-moving and a right-moving Type I algebra. We also find a remarkable property of the Kac-Moody algebra for supermembranes and Type IIA superstrings which is likely to play an important role in finding the superspace constraints for d=11, N=1 and d=10, N=2α supergravity theories, by a generalisation of the notion of integrability along light-like lines. (author). 9 refs.

6084 (IC–89/208) **New link polynomial obtained from octet representation of quantum sl(3) enveloping algebra.** Ma Zhongqi. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 15p. Order Number DE90610499. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The quantum Clebsch-Gordan coefficients for the coproduct 8x8 of the quantum sl(3) enveloping algebra are computed. In the decomposition of the coproduct 8x8, there are two octet representations which are identified by the symmetry in changing the order of the factor octet representations. The corresponding R_q matrix, and a new link polynomial are obtained. (author). 14 refs, 3 tabs.

6085 (IC–89/213) **A less constrained (2,0)-super-Yang-Mills model.** Chair, N.; Helayel-Neto, J.A.; Smith, A.W. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 10p. Order Number DE90610500. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The (2,0)-super-Yang-Mills theory is reconsidered and superspace constraints are suitably chosen so that two gauge component fields appear which transform under a common Yang-Mills group. Their coupling to (2,0) non-linear σ-models is also discussed. (author). 13 refs.

6086 (IC–89/243) **In praise of quantum fields.** Shirkov, D.V. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 16p. Order Number DE90610501. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A comprehensive discussion of several topics vital for the structure of a modern Quantum Field Theory are discussed, namely: physical content of the notion of a Quantum Field; meaning of infinite renormalization; renormalizability as quantizability; the influence of several principles of quantum nature (quantizability, gauge dynamics, supersymmetry) on quantum fields dynamics; main trends of QFT evolution; present status of QFT and its frontier role in physics. (author). 15 refs, 1 fig.

6087 (IC–89/247) **Point particle with extrinsic curvature.** Huq, M. (International Centre for Theoretical Physics, Trieste (Italy)); Obiakor, P.I.; Singh, S. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 17p. Order Number DE90610502. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

We have considered point particle action with extrinsic curvature having a geometric interpretation. It is shown that the hamiltonian formalism possesses more gauge symmetries than the lagrangian formalism. Equivalence of BRST method in both formalism is also exhibited. (author). 11 refs.

6088 (IC–89/284) **A new class of compactification of the eleven-dimensional supermembranes.** Vassilevich, D.V. International Centre for Theoretical Physics, Trieste (Italy). Sep 1989. 8p. Order Number DE90610504. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

We construct new types of solutions of supermembranes field equations. Every compactification of the eleven-dimensional supergravity admits membrane vacuum of this type. (author). 8 refs.

6089 (IC–89/291) **A note on gauge fixing in theories of extended objects.** Sezgin, E. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 11p. Order Number DE90610505. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

We discuss the light-cone type gauges (old and new) and the associated residual symmetries in theories of extended objects. We also discuss certain covariant gauges and in particular a covariant gauge for membranes which admits the contact diffeomorphisms of the world-volume as a residual symmetry. (author). 12 refs.

6090 (IFVE-OTF–88-208) **Straight-line string in the background electromagnetic field.** Nanobashvili, G.G. (Tbilisskij Gosudarstvennyj Univ., Tbilisi (USSR)); Pron'ko, G.P. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. 20p. (In Russian). Order Number DE90608915. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The electrodynamics of the straight-line string with the charges on its ends has been built. The classical mechanics of the string in the background electromagnetic field and the classical field theory of the straight-line string and photons are considered. 11 refs.

6091 (INFN-LNF–89-020(RT)) **Coulombic potential in the strong coupling limit of compact QED with quasiperiodic boundary conditions.** Palumbo, F. (Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Lab. Nazionale di Frascati). Istituto Nazionale di Fisica Nucleare, Rome (Italy). 1989. 8p. Order Number DE90610506. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

It is shown that the linear potential is not an intrinsic feature of the compact formulation of gauge theories in the strong coupling limit, but depends on the choice of boundary conditions (b.c.) of the state functional with respect to the gauge fields. In the abelian case for strictly periodic b.c. the potential is linear, while for a proper choice of quasi-periodic b.c. the potential is Coulombic.

6092 (INFN-LNF–89/043(PT)) **Noncompact formulation of abelian gauge theories in lattice and charge quantization.** De Franceschi, G. (Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Lab. Nazionale di Frascati); Palumbo, F. Istituto Nazionale di Fisica

Nucleare, Rome (Italy). 1989. 10p. Order Number DE90608916. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

It is pointed out that in the Hamiltonian formulation of gauge theories on lattice consistency of the Gauss constraint requires that the gauge group be compact. As a consequence the electric charge is quantized irrespective of the compactness of the transverse gauge field.

6093 (IPP–6/257) **Integrable and nonintegrable non-KAM Hamiltonians and magnetic field topology.** Salat, A. Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.). Jan 1986. 35p. Order Number DE90729142. Available from NTIS (US Sales Only), PC A03/MF A01.

The integrability of Hamiltonians $H(P_1, P_2, Q_1, Q_2)=P_1G_1(Q_1,Q_2)+P_2G_2(Q_1,Q_2)$, with arbitrary analytic G_1 and G_2, 2π-periodic in Q_1 and Q_2, is analytically investigated. Such H cannot be separated into two parts, $H=H_0+H_{21}$, such that the KAM theorem would apply for vertical strokeH_1vertical stroke<<vertical strokeH_0vertical stroke. For G_2=const such Hamiltonians correspond to toroidal magnetic fields with constant rotational transform. Integrability is then equivalent to the existence of closed magnetic surfaces. The winding number w of the Q_1, Q_2 flow (i.e. the rotational transform) is rational in 'tongue'-like domains in $(\omega_2/\omega_1,A)$ diagrams. Here $\omega_i = \langle G_i \rangle$ is the average over both Q_1 and Q_2, $G_i=\omega_i+F_i$, i=1, 2, and A is an amplitude parameter of F_i (F_i=0 for A=0). Integrability is proved almost everywhere in the complementary domains, namely where w is sufficiently irrational. In the generic case ('conditional') nonintegrability is proved for the class $dG_1/dQ_1+dG_2/dQ_2=0$ in the tongues, which in this case shrink to lines with $w=\omega_1/\omega_2$. It is shown that if the number of dimensions in the Hamiltonian were larger than two, qualitatively different results would be expected. (orig.).

6094 (IYaF–89-1) **Spinning particle in a gravitational field.** Khriplovich, I.B. AN SSSR, Novosibirsk (USSR). Inst. Yadernoj Fiziki. 1988. 10p. Order Number DE90608917. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The equations of motion of a spinning particle in an external gravitational field are derived in a simple and general way. The extra force that makes the motion a nongeodesic one is a gravitational analogue of the Lorentz force. Arguments are given that fix the general form of the wave equation for particles of arbitrary spin in electromagnetic and gravitational fields.

6095 (JINR-R–17-88-630) **Renormalization group in statistical physics - momentum and real spaces.** Yukalov, V.I. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1988. 21p. (In Russian). Order Number DE90610507. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Two variants of the renormalization group approach in statistical physics are considered, the renormalization group in the momentum and the renormalization group in the real spaces. Common properties of these methods and their differences are cleared up. A simple model for investigating the crossover between different universality classes is suggested. 27 refs.

6096 (LA-UR–89-3784) **The large coefficient problem; can we make sense out of QCD perturbation theory?.** West, G.B. Los Alamos National Lab., NM (USA). [1989]. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8907136–2: NATO advanced research workshop on radiative corrections: results and perspectives, Brighton (UK), 9-14 Jul 1989). Order Number DE90003212. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

There is the possibility of an impending crisis looming on the horizon for QCD. The problem is that in many processes, large coefficients arise in the perturbation series expansion leading to serious uncertainties concerning its predictive power. Until recently most of the examples of such a phenomenon occurred in the calculation of decay rates. These were, by and large, either ignored or dismissed using possible scheme-dependence arguments as a way out. However, more recently a calculation of the 3-loop contribution to the total e^+e^- annihilation cross-section was performed which gave an enormous coefficient of the order of 50 times that of the 2-loop term. If correct, this would imply that the 3-loop contribution actually exceeds that of the 2-loop! Thus, from a conservative viewpoint, the validity of the perturbation series expansion as an estimate for the total e^+e^- cross-section is called into question. Since this process has played a key role in the development and understanding of QCD and since, in many ways, it is one of the cleanest methods for extracting α_s the problem can no longer be avoided. Furthermore, there is no reason to doubt that this problem should occur in all physical processes. Coming to grips with it is, of course, not only important for testing QCD but also for extracting fundamental quantities such as α_s. Clearly one needs to understand the nature and origin of such large coefficients before one can confidently continue to use perturbative estimates. The purpose of this talk is to focus on these problems. I shall first review the experimental situation with some examples illustrating the problem. I shall then discuss various general components and properties of perturbation theory before attempting to give a possible resolution of the problem. 18 refs., 5 figs.

6097 (LA-UR–89-4030) **QCD spectrum from the lattice.** Gupta, R. Los Alamos National Lab., NM (USA). [1989]. 9p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8909221–3: HADRON '89: 3rd international conference on hadron spectroscopy, Ajaccio (France), 23-27 Sep 1989). Order Number DE90003222. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Considerable progress has been made in the last year to derive the spectrum from QCD in the quenched approximation. I review the results for the proton to rho mass ratio and show that we are close to getting results to within 10%. I present new results for 0^{++} and 2^{++} glueballs. These results are qualitative since we do not address the question of mixing of glueballs with quark states. Finally, I give a status report on the full QCD calculations (2 flavors of dynamical Wilson fermions) being done on the Connection Machine 2. 12 refs., 3 figs.

6098 (OUP–89-06) **Low energy restrictions for a flipped E_6 model.** Eeg, J.O. Oslo Univ. (Norway). Fysisk Inst. Apr 1989. 12p. Order Number DE90610508. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Low energy restrictions for a "flipped" E 6 model proposed by E. Ma are considered. The model includes a right-handed W-boson with odd R-parity. The new interactions due to W R-exchange have no significant impact on rare kaon decays, because the W R does not couple to quarks. On the other hand, W R exchanges induce rare processes like D - anti D mixing, D^o - μ anti μ, D^o - μ anti e, μ - eγ, μ - 3e, and μN - eN. With reasonable extra assumptions it is found that the exotic right-handed W-boson is likely to be heavier than 500 to 1500 GeV, the strongest bound coming from D - anti D mixing. 21 refs.

6099 (RAL–89-076) **Status and future of lattice gauge theory.** Hoek, J. Rutherford Appleton Lab., Chilton (UK). Jul 1989. 7p. Sponsored by U.K. Science and Engineering Research Council. (CONF-8907171–1: Symposium on the formation and evolution of cosmic strings, Cambridge (UK), 2-7 Jul 1989). Order Number DE90000522. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI.

In this talk I would like to describe the current status of lattice QCD calculations, the computer requirements to obtain physical results and the direction computing is taking. 7 refs.

65 PHYSICS II

6510 Nuclear Physics

Refer also to citation(s) 5777, 6159

6100 (CTA-IEAv-NT–05/84) **Development and implantation of application systems for reduction and analysis of experimental data in Nuclear Physics area.** Cardoso Junior, J.L.; Schelin, H.R.; Lemos, B.J.K.C.; Tanaka, E.H.; Castro, A.T.C.G. Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados. 1984. 31p. (In Portuguese). Order Number DE90608645. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Several application systems for reduction and analysis of experimental data are described. These codes were development and/or implanted in tee IEAv/CTA CYBER 170/750 system. A brief description of the experimental data acquisition modes and the necessary reduction for analysis is given. Information on the purposes, uses and access of the codes are given.

6101 (DOE/ER/01067–T7) **[Studies of nuclear structure using neutrons and charged particles]: Progress report, September 1, 1988–August 31, 1989.** Triangle Universities Nuclear Lab., Durham, NC (USA). 1989. 143p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-76ER01067;FG05-88ER40441;FG05-88ER40442. Order Number DE90003231. Available from NTIS, PC A08/MF A01; OSTI; INIS; GPO Dep.

This report contains brief discussions on nuclear research done at Triangle Universities Nuclear Laboratory. The major categories covered are: Fundamental symmetries in the nucleus; Dynamics in very light nuclei; D states in light nuclei; Nucleon-nucleus interactions; Nuclear structure and reactions; and Instrumentation and development. (LSP)

6102 (DOE/ER/40501–1) **Photon interactions with nuclei: Progress report.** Thornton, S.T.; Sealock, R.M. Virginia Univ., Charlottesville, VA (USA). 9 Nov 1989. 42p. Sponsored by U.S. DOE Energy Research. DOE Contract FG05-89ER40501. Order Number DE90003669. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This document is a progress report for DOE Grant No. FG05-89ER40501, A000. The grant began March, 1989. Our primary research effort has been expended at the LEGS project at Brookhaven National Laboratory. This report will summarize our present research effort at LEGS as well as data analysis and publications from previous experiments performed at SLAC. In addition the principal investigators are heavily involved in the CLAS collaboration in Hall B at CEBAF. We have submitted several letters of intent and proposals and have made commitments to construct experimental equipment for CEBAF. We expect our primary experimental effort to continue at LEGS until CEBAF becomes operational. This report will be divided into separate sections describing our progress at LEGS, SLAC, and CEBAF. We will also discuss our significant efforts in the education and training of both undergraduate and graduate students. Photon detectors are described as well as experiments on delta deformation in nuclei of quasielastic scattering and excitation of the delta by $^{4}He(e,e')$.

6103 (INDC(CCP)–304/L) **Translation of selected papers published in Nuclear Constants 1, 1987.** International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Sep 1989. 52p. Order Number DE90609270. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Translated by the IAEA. Original report in Russian was distributed as INDC(CCP)-276/G.

The document contains the following three papers: The Library of Recommended Evaluated Neutron Cross-Sections for the Most Important Nuclear Fission Products; Nuclear Data Libraries used at the Shkoda Power Engineering Plant; Measurement and Analysis of Neutron Scattering Cross-Sections for the Nuclei of Structural Materials in the 0.5-9.0 MeV Region. A separate abstract was prepared for each of these papers. Refs, figs and tabs.

6104 (INDC(CCP)–304/L, pp. 31-52) **Measurement and analysis of neutron scattering cross-sections for the nuclei of structural materials in the 0.5-9.0 MeV region.** Korzh, I.A. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Sep 1989. In *Translation of selected papers published in Nuclear Constants 1, 1987.* Order Number DE90609270. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Translated by the IAEA. Original report in Russian was distributed as INDC(CCP)-276/G.

The differential and integral neutron elastic and inelastic scattering cross-sections were obtained for ^{24}Mg, ^{48}Ti, ^{52}Cr, ^{54}Fe, $^{58,60,64}N$ and $^{92,94}Mo$ nuclei at 1.5, 2, 2.5, 3, 5, 6 and 7 MeV, for ^{62}Ni, $^{76,78,80,82}Se$ and $^{126,130}Te$ nuclei at 1.5, 2, 2.5, 3 and 5 MeV, for $^{50,54}Cr$, ^{56}Fe, $^{64,66,68}Zn$ and ^{209}Bi nuclei at 1.5, 2, 2.5 and 3 MeV and for ^{16}O, ^{28}Si, ^{32}S and nickel nuclei at 5 MeV. These experimental data, together with the data of other authors at comparable energies, were analysed using the spherical optical model, the statistical model and the coupled-channel model. 100 refs, 8 figs.

6105 (INDC(NDS)–223/GF, pp. 57-61) **Work on fusion activation at Harwell.** Forrest, R.A. (UKAEA Harwell Lab. (UK)). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8905244–: IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna (Austria), 8-11 May 1989). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The paper presents the work on fusion activation at Harwell in the following fields: cross section data, decay data, inventory code (FISPACT) and applications of code, experiments and biological hazard data.

6106 (INDC(NDS)–223/GF, pp. 62-65) **European activation library for fusion reactor technology.** Kopecky, J. (Netherlands Energy Research Foundation, Petten (Netherlands)). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8905244–: IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna (Austria), 8-11 May 1989). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The EAF-project is part of the European Fusion Technology Programme of the European Community. The ultimate goal of these activities is to create a general inventory code and data libraries for calculation of activation and transmutations in materials used in fusion reactor technology. 8 refs.

6107 (INDC(NDS)–223/GF, pp. 254-262) **Activation cross section library UKACT1 and the inventory code FISPACT.** Forrest, R.A. (UKAEA Harwell Lab. (UK). Nuclear Physics and Instrumentation Div.). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8711217–: IAEA Specialists' meeting on the Fusion Evaluated Nuclear Data Library related to the ITER activity, Vienna (Austria), 16-18 Nov 1987). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The UK activation library for fusion applications, UKACT1, supersedes the existing UKCTRIIIA library. It contains neutron induced reaction data for 8719 reactions on 625 target nuclides. The library is used by the inventory code FISPACT which is a modified version of the existing code FISPIN. A library of decay information for all the 1314 nuclides involved is also required for calculations and this is also briefly described. UKACT1 will be used for irradiation calculations and as the starting point for a new version which will contain improved data for the most important reactions. These will be identified using the sensitivity subroutine in FISPACT. 16 refs, 1 fig., 2 tabs.

6108 (INP–1301/PH) **Pseudorapidity distributions from pion-emulsion interactions in the energy range 60 GeV to 300 GeV.** Holynski, R.; Jezabek, M.; Wozniak, K. Institute of Nuclear Physics, Cracow (Poland). 1986. 28p. Order Number DE90610721. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The analysis of experimental data for pion-nucleus interactions in the energy range 60 GeV - 300 GeV is presented. The pseudorapidity distributions of shower particles are analyzed in terms of pion energy and the average number of intranuclear collisions of the projectile. The particle densities in the projectile fragmentation region are compared to predictions of the additive quark model. The relation between the average number of wounded quarks in the projectile and the number of fast protons emmited from the struck nucleus is derived and used to extract from the experimental π^- -

emulsion data the fragmentation functions for both wounded and spectator quarks. These functions are then used to describe the results of independent π^- - proton and π^- - deuteron experiments. 18 refs., 10 figs., 1 tab. (author).

6109 (INP–1303/PH) **Interactions of hadrons in nuclear emulsion in the energy range 60 GeV - 400 GeV.** Holynski, R. Institute of Nuclear Physics, Cracow (Poland). 1986. 99p. (In Polish). Order Number DE90610722. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Interactions of pions and protons in the energy range 60 GeV in nuclear emulsion have been analysed. The fragmentation process of the struck nucleus as well as the multiple production of relativistic particles have been investigated as a function of the primary energy and the effective thickness of the target. It is shown that both, the fragmentation of the target nucleus and particle production, can be described by models in which the projectile (or its constituents) undergoes multiple collisions inside the target nucleus. In particular the particle production in the projectile fragmentation region in pion-nucleus interactions is well described by the additive quark model. 47 refs., 35 figs., 2 tabs. (author).

6110 (INP–1322/PH) **Interactions of the 800 GeV protons from Fermilab with the emulsion nuclei.** Abdurazakova, Y.A. (AN Uzbekskoj SSR, Tashkent (USSR). Inst. Yadernoj Fiziki); Abduzhamilov, A.; Abduzhamilov, Sh. and others; Baton Rouge-Cracow-Moscow-Tashkent Collaboration. Baton Rouge-Cracow-Moscow-Tashkent Collaboration. Institute of Nuclear Physics, Cracow (Poland). 1986. 20p. Order Number DE90610723. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

We present first results of the analysis carried out in our laboratories on the 800 GeV proton-emulsion data obtained from the Fermi National Accelerator Laboratory experiment No. 508. The multiplicity distributions of secondary particles and the pseudorapidity distribution of shower particles are analyzed and compared with those obtained at lower energies. (author).

6111 (ORNL/FTR–3417) **[Heavy Ions as probes of nuclei far from stability]: Foreign trip report, October 1, 1989–October 13, 1989.** Toth, K.S. Oak Ridge National Lab., TN (USA). 20 Oct 1989. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90002484. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The traveler presented a talk entitled "Heavy Ions as Probes of Nuclei Far From Stability," and chaired a session at the International School-Seminar, Dubna, USSR, October 3–12, 1989. He also visited two of the laboratories that make up the Joint Institute for Nuclear Research.

6112 (SAND–89-1612C) **Optically detected magnetic resonance of sulfur doped gallium phosphide.** Brower, K.L. Sandia National Labs., Albuquerque, NM (USA). [1989]. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-891119–15: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989). Order Number DE90003485. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

An isotropic optically detected magnetic resonance (ODMR) having a Lorentzian lineshape at $g = 2.050 \pm 0.003$ and linewidth (FWHM) of 67.3 mT is observed in GaP doped with $6–9 \times 10^{17}$ S/cm^3. The ODMR at $g = 2.050$ is believed to arise from free electrons (or holes) in the conduction (valence) band. This ODMR is completely quenched due to non-radiative recombination in the vicinity of $g = 1.99$. 6 refs., 3 figs.

6512 Nuclear Properties and Reactions, A = 1-5, Experimental

Refer also to citation(s) 5602

6113 (INDC(NDS)–223/GF, pp. 237-253) **Status of Japanese nuclear data evaluation for fusion application.** Shibata, Keiichi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan)). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8711217–:). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

Nuclear data evaluations have been performed for the third version of Japanese Evaluated Nuclear Data Library (JENDL-3). In the JENDL-3 evaluation, much emphasis was placed on the application to fusion neutronics. This paper gives a brief review of the evaluations of light nuclides and structural materials. Post JENDL-3 activities are also described. (author). 30 refs, 17 figs, 1 tab.

6513 Nuclear Properties and Reactions, A = 6-19, Experimental

Refer also to citation(s) 6113

6114 (INDC(NDS)–223/GF, pp. 223-236) **Lawrence Livermore National Laboratory ^{9}Be evaluation.** Perkins, S.T.; Plechaty, E.F.; Howerton, R.J. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8711217–:). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The evaluated data on ^{9}Be obtained at the Lawrence Livermore National Laboratory using a Monte Carlo technique for the analysis of neutron reactions and the experimental data on cross sections measured at LLNL are presented. 19 figs.

6514 Nuclear Properties and Reactions, A = 20-38, Experimental

Refer also to citation(s) 6160, 6172

6515 Nuclear Properties and Reactions, A = 39-58, Experimental

Refer also to citation(s) 6113, 6120, 6160, 6341

6115 (INDC(CCP)–302/L, pp. 63-74) **Re-evaluation of the neutron cross-sections for iron.** Pronyaev, V.G.; Ignatyuk, A.V. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. In *Translation of selected papers published in Nuclear Constants 4, 1986.* Order Number DE90607803. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Translated by the IAEA. Original report in Russian was distributed as INDC(CCP)-268/G.

In spite of the abundance of evaluated neutron cross-sections files for iron and its isotopes, there is a need to continue the work of evaluating the cross-sections of this very important structural material because new results have been published (which have extended the resolved resonance region) and none of the available evaluations offers good-quality data for the calculation of systems with different spectra, for example, fast reactors and fission reactors. 21 refs, 7 figs, 1 tab.

6116 (INDC(NDS)–223/GF, pp. 50-56) **Consistency of microscopic evaluations and integral experiments for some structural materials.** Pronyaev, V.G.; Blokhin, A.I.; Golubev, V.I.; Ignatyuk, A.V.; Tsibulya, A.M. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8905244–: IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna (Austria), 8-11 May 1989). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The new version (CJD-2) of the evaluated neutron cross-section files for natural chromium, iron and nickel is based mainly on the experimental data published before 1983 and physical models for

interpolation and extrapolation of the cross-sections. This paper presents the specific features of the evaluated data files important for their application in neutronics calculations of the fast neutron and fusion reactors. 14 refs, 1 fig., 1 tab.

6117 (INDC(NDS)–223/GF, pp. 187-194) **Description of evaluations for ^{50,52,53,54}Cr performed for ENDF/B-VI.** Larson, D.C. (Oak Ridge National Lab., TN (USA)); Hetrick, D.M.; Fu, C.Y. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8711217–:). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

Isotopic evaluations for ^{50,52,53,54}Cr performed for ENDF/B-VI are briefly reviewed. The evaluations are based on analysis of experimental data and results of model calculations which reproduce the experimental data. Evaluated data are given for neutron induced reaction cross sections, angular and energy distributions, and for gamma-ray production cross sections associated with the reactions. File 6 formats are used to represent energy-angle correlated data and recoil spectra. Uncertainty files are included for the major cross sections. Detailed evaluations are given for ^{52,53}Cr, and results of calculations for reactions with large cross sections are used for evaluation of the minor isotopes. (author). 27 refs, 6 figs.

6118 (INDC(NDS)–223/GF, pp. 204-211) **Description of evaluations for ^{54,56,57,58}Fe performed for ENDF/B-VI.** Larson, D.C. (Oak Ridge National Lab., TN (USA)); Fu, C.Y.; Hetrick, D.M. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8711217–:). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

Isotopic evaluations for ^{54,56,57,58}Fe performed for ENDF/B-VI are briefly reviewed. The evaluations are based on analysis of experimental data and results of model calculations which reproduce the experimental data. Evaluated data are given for neutron induced reaction cross sections, angular and energy distributions, and for gamma-ray production cross sections associated with the reactions. File 6 formats are used to represent energy-angle correlated data and recoil spectra. Uncertainty files are included for the major cross sections. A detailed evaluation is given for ^{56}Fe and results of calculations for the major reactions are used for evaluations of the minor isotopes, with particular attention paid to inelastic scattering to the low-lying levels in ^{57}Fe. (author). 26 refs, 5 figs.

6119 (INP–1313/PL) **Element distributions after binary fission of ^{44}Ti.** Planeta, R. (Uniwersytet Jagiellonski, Cracow (Poland). Inst. Fizyki); Brzychczyk, J.; Belery, P. and others. Institute of Nuclear Physics, Cracow (Poland). 1986. 48p. Order Number DE90610724. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Inclusive and coincidence measurements have been performed to study symmetric fragmentation of ^{44}Ti binary decay from the ^{32}S + ^{12}C reaction at 280 MeV incident energy. Element distributions after binary decay were measured. Angular distributions and fragment correlations are presented. Total CM kinetic energy for the symmetric products is extracted from our data and from Monte-Carlo model calculations including Q-value fluctuations. This result was compared to liquid drop model calculations and standard fission systematics. Comparison between the experimental value of total kinetic energy (TKE) and the rotation liquid drop model predictions locates the angular momentum window for symmetric splitting of ^{44}Ti between 33 and 38 h. It also showed that 50% of the corresponding rotational energy contributes to the TKE values. The dominant reaction mechanism was found to be symmetric splitting followed by evaporation. 25 refs., 16 figs., 2 tabs. (author).

6516 Nuclear Properties and Reactions, A = 59-89, Experimental

Refer also to citation(s) 6113, 6116, 6341

6120 (INDC(NDS)–223/GF, pp. 195-203) **Description of evaluations for ^{58,60,61,62,64}Ni performed for ENDF/B-VI.** Larson, D.C. (Oak Ridge National Lab., TN (USA)); Hetrick, D.M.; Fu, C.Y. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8711217–:). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

Isotopic evaluations for ^{58,60,61,62,64}Ni performed for ENDF/B-VI are briefly reviewed. The evaluations are based on analysis of experimental data and results of model calculations which reproduce the experimental data. Evaluated data are given for neutron induced reaction cross sections, angular and energy distributions, and for gamma-ray production cross sections associated with the reactions. File 6 formats are used to represent energy-angle correlated data and recoil spectra. Uncertainty files are included for the major cross sections. Detailed evaluations are given for ^{58,60}Ni, and results of calculations for the major reactions are used for evaluations of the minor isotopes. (author). 29 refs, 8 figs.

6121 (INDC(NDS)–223/GF, pp. 212-219) **Description of evaluations for ^{63,65}Cu for ENDF/B-VI.** Larson, D.C. (Oak Ridge National Lab., TN (USA)); Hetrick, D.M.; Fu, C.Y. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8711217–:). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

Isotopic evaluations for ^{63,65}Cu performed for ENDF/B-VI are briefly reviewed. The evaluations are based on analysis of experimental data and results of model calculations which reproduce the experimental data. Evaluated data are given for neutron-induced reaction cross sections, angular and energy distributions, and for gamma-ray production cross sections associated with the reactions. File 6 formats are used to represent energy-angle correlated data and recoil spectra. Uncertainty files are included for the major cross sections. Full evaluations are given for ^{63,65}Cu. (author). 21 refs, 7 figs.

6517 Nuclear Properties and Reactions, A = 90-149, Experimental

Refer also to citation(s) 6160, 6341

6122 (INDC(CCP)–304/L, pp. 5-15) **Library of recommended evaluated neutron cross-sections for the most important nuclear fission products.** Ignatyuk, A.V.; Kravchenko, I.V.; Manturov, G.N. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Sep 1989. In *Translation of selected papers published in Nuclear Constants 1, 1987.* Order Number DE90609270. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Translated by the IAEA. Original report in Russian was distributed as INDC(CCP)-276/G.

For many fission products the capture cross-section evaluations in different existing compilations show significant discrepancies. In order to eliminate these discrepancies the Nuclear Data Centre of the USSR State Committee on the Utilization of Atomic Energy has analysed all existing experimental data on resonance and fast neutron radiative capture cross-sections. Following this review, a library of recommended evaluated neutron data was compiled for the 27 most important fission products. This paper briefly describes the evaluations included in the library and analyses the errors associated with them. 20 refs, 3 figs, 3 tabs.

6123 (INIS-mf–12013, pp. 101-103) **Investigation of the reaction mechanism of deep-inelastic reactions by the Crystal**

Ball. Helmolt, H.U. v. (Heidelberg Univ. (Germany, F.R.). Physikalisches Inst.); Gerl, J.; Glaessel, P.; Schmidt-Fabian, R.; Schwalm, D.; Habs, D. Max-Planck-Institut fuer Kernphysik, Heidelberg (Germany, F.R.). 1988. (In German). In *Max-Planck-Institute for Nuclear Physics. Annual report 1987.* Order Number DE90722124. Available from NTIS (US Sales Only), PC A10/MF A01.

The investigation of deep-inelastic reactions with the Darmstadt-Heidelberg Crystal Ball has been continued. Pronounced structures in the delayed multiplicity for 640 MeV ^{96}Mo->^{96}Mo near mass symmetry are interpreted as additionnally emitted neutrons caused by nuclear structure effects, in agreement with calculations performed with the CASCADE evaporation code. A new method has been developed employing the delayed multiplicity information for the preparation of the reaction mechanism. As a result it could be shown for the first time that the v-shaped dependence of γ-multiplicity from mass persists up to the highest energy losses. A comparison of theoretical predicitons for the γ-multiplicities vs. energy loss with measured distributions shows that theory overestimates the rise of the observed γ-multiplicity, but is otherwise in qualitative agreement. (orig.).

6124 (LUIP–8812) **On the observation of a transition from fusion to multifragmentation in high multiplicity ^{16}O induced reactions.** Jakobsson, B. (Lun Univ. (Sweden). Dept. of Physics); Joensson, G.; Karlsson, L. and others. Lund Univ. (Sweden). Dept. of Cosmic and Subatomic Physics. Apr 1989. 25p. (LUNFD6-NFFK–7095-1-24-1988). Order Number DE90610725. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

We have studied high multiplicity $^{16}O_+$ Br and $^{16}O_+$ Ag collisions from 10A to 220A MeV on an event-by-event basis. The collisions with the highest multiplicity are fusion-like for energies below 35A MeV whereas at higher energies the onset of multifragmentation (two or more medium mass fragments) is observed with a charge distribution which gets less and less wide with increasing energy. Correlations between high moments of the charge distribution and the maximum charge or the total multiplicity have been studied. These correlations are generally well described by statistical models. The predicted clear signal of critical behavior is however not observed. (30 refs.) (authors).

6125 **Heavy ion fission - an inherently non-equilibrium process?.** Gavron, A. (Los Alamos National Lab., NM (USA)). *Nuclear Physics [Section] A (Netherlands),* 502: 502 (9 Oct 1989). (CONF-890491–: International conference on fifty years of research in nuclear fission, Berlin (Germany, F.R.), 3-7 Apr 1989).

Recent measurements of neutron emission in coincidence with fission fragments indicate a strong enhancement of the neutron multiplicity preceeding fission compared with statistical model calculations. This enhancement has enabled the determination of the reduced nuclear dissipation coefficient β which, in turn, indicates that nuclear collective motion is overdamped. We examine some possible sources of error in this determination and speculate on the consequences of the obtained value of β. (orig.).

6518 Nuclear Properties and Reactions, A = 150-189, Experimental

Refer also to citation(s) 6122

6126 (OUP–88-22) **Gamma-decay of ^{172}Yb after the (tau, tau) inelastic reaction.** Atac, A.; Guttormsen, M.; Rekstad, J.; Tveter, T.S. Oslo Univ. (Norway). Fysisk Inst. Dec 1988. 24p. Order Number DE90609284. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The γ-decay following the ^{172}Yb (tau,tau) reactions with E tau = 45 MeV has been studied. Enhanced transitions with energies of E $\gamma \sim 1$ MeV were found in the γ-decay pattern. Around 50% of this radiation consists of known transitions orginating from the 1-2 MeV region and feeding into the ground state band at low spins. However, unresolved γ-ray lines constitute a considerable fraction of the bump. The γ-decay from the highest excitation energies (E chi $\sim$ 5-8 MeV) is found to be well described taking into account the transition probability imposed by the giant dipole resonance.

6127 (OUP–89-16) **Statistical gamma decay at low angular momentum.** Guttormsen, M. (Oslo Univ. (Norway). Fysisk Inst.); Atac, A.; Messelt, S.; Ramsoey, T.; Rekstad, J.; Tveter, T.S.; Loevhoeiden, G.; Thorsteinsen, T.F.; Zelazny, Z. Oslo Univ. (Norway). Fysisk Inst. Sep 1989. 29p. Order Number DE90610727. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The report summarizes results on nuclear structure of rare earth nuclei at high intrinsic excitation energy and low spin obtained with the (^{3}He,^{4}He) and (^{3}He,^{3}He) reactions. For E chi > 4.5 MeV it is shown that the γ-spectra from the two reactions are similar, indicating that equilibrium is present prior to γ-emission. An unresolved γ-ray bump at 1 MeV was observed in the decay. This structure is ascribed the depopulation of the vibrational regime, defined around E chi = 1-2 MeV, to the ground state band. Unexpected low-energy γ-rays were found at high excitation energy. The technique of extracting first-generation γ-ray spectra is described and preliminary results from the new CACTUS multidetector system are presented.

6519 Nuclear Properties and Reactions, A = 190-219, Experimental

Refer also to citation(s) 6160, 6172, 6179

6128 (INDC(NDS)–223/GF, pp. 66-74) **Brief description of evaluation of lead isotopes for JENDL-3.** Mizumoto, M. (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan)). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8905244–: IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna (Austria), 8-11 May 1989). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

An evaluation of data for neutron induced reactions on lead isotopes and natural lead have been carried out for JENDL-3. The major improvements compared with JENDL-2 are the evaluations to include direct reaction process and multi-step statistical mode calculations. The gamma-ray production cross section and energy spectra have been newly evaluated. 14 refs, figs, 1 tab.

6129 (INDC(NDS)–223/GF, pp. 75-84) **Status of lead cross sections and benchmark calculations.** Cheng, E.T. (General Atomics, San Diego, CA (USA)). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8905244–: IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna (Austria), 8-11 May 1989). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The evaluated data for (n,2n) reaction cross sections in lead, multiplication factors in Pb shells, leakage spectra from lead, activation rates for (n,n'), (n,p), (n,α) and (n,2n) reactions and fission reaction rates are presented in tables and graphs.

6520 Nuclear Properties and Reactions, A = 220 and Above, Experimental

Refer also to citation(s) 6163, 6165

6130 (IAE–4685-2) **Alpha and gamma spectroscopy of fission isomers.** Makarenko, V.E. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. 1988. 20p. (In Russian). Order Number DE90609292. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The attempts to discover in the experiment decay of fission isomers of heavy nuclei in the U-Am range by emitting α particles or γ quanta are considered. Some facilities for searching αdecay of spontaneously fissile isomers are given in brief. The first experimental results are discussed.

6131 (INDC(CCP)–302/L, pp. 15-32) **Evaluation of nuclear data for heavy fissile nuclei.** Kon'shin, V.A. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. In *Translation of selected papers published in Nuclear Constants 4, 1986.* Order Number DE90607803. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Translated by the IAEA. Original report in Russian was distributed as INDC(CCP)-268/G.

Significant progress has been made in recent years in the theoretical interpretation of neutron cross-sections. Neutron data have been evaluated using the coupled channel method, accurate models for level density and transitional fission states, and a multistep statistical model taking into account the possibility of pre-equilibrium decay, thus making further development possible in the evaluation of neutron cross-sections. 23 refs, 9 figs.

6132 (INDC(CCP)–302/L, pp. 33-40) **Absolute measurements of the fission cross-sections for important nuclides.** Shpakov, V.I. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. In *Translation of selected papers published in Nuclear Constants 4, 1986.* Order Number DE90607803. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

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Since 1975 the V.G. Khlopin Radium Institute in Leningrad and the Technical University of Dresden have been working together on absolute measurements of the fission cross-sections for the most important reactor nuclides. This paper reviews the results of measurements carried out in 1984-1985. 10 refs, 4 figs, 1 tab.

6133 (INDC(CCP)–302/L, pp. 41-51) **Measurement and analysis of radiative capture cross-sections of neptunium and uranium isotopes.** Tolstikov, V.A. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. In *Translation of selected papers published in Nuclear Constants 4, 1986.* Order Number DE90607803. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Translated by the IAEA. Original report in Russian was distributed as INDC(CCP)-268/G.

An analysis of evaluated neutron radiative capture cross-sections for ^{236}U, ^{238}U and ^{237}Np in respect with accuracy requirements is performed. 36 refs, 3 figs.

6134 (INDC(CCP)–302/L, pp. 53-61) **Consistent evaluation of neutron cross sections for the $^{242-244}Cm$ isotopes.** Ignatyuk, A.V.; Maslov, V.M. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. In *Translation of selected papers published in Nuclear Constants 4, 1986.* Order Number DE90607803. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Translated by the IAEA. Original report in Russian was distributed as INDC(CCP)-268/G.

The knowledge of neutron cross-sections for Curium isotopes is necessary for solving the problems of the external fuel cycle. Experimental information on the cross-sections is very meager and does not satisfy requirements and existing evaluations in different libraries differ substantially for fission and (n,2n) reaction cross-sections. This situation requires a critical review of the entire set of evaluations of the neutron cross-sections for Curium. 17 refs, 3 figs.

6135 (INDC(CCP)–302/L, pp. 75-83) **Evaluation of cross-sections for the fission of curium isotopes by fast neutrons.** Fursov, B.I.; Kudyaev, G.A.; Smirenkin, G.N. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. In *Translation of selected papers published in Nuclear Constants 4, 1986.* Order Number DE90607803. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Translated by the IAEA. Original report in Russian was distributed as INDC(CCP)-268/G.

A more realistic evaluation of fission cross-sections for Curium isotopes 242, 243, 244, 245, 246, 247 and 248 is performed from existing experimental data using the same algorithm for all the isotopes. 16 refs, figs.

6136 (INDC(NDS)–220, pp. 59-64) **Kinetic energies of fragments and average number of prompt neutrons in neutron-induced fission of thorium-232.** Goverdovsky, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.); Kuzminov, B.D.; Mitrovanov, V.F.; Sergachev, A.I. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

In this work an analysis of the correspondence between the changes of the kinetic energy of fragments and the average number of prompt neutrons near a barrier of fission and near the (n, n'f) reaction threshold in the neutron-induced fission of thorium-232 is carried out. (author). 10 refs, 2 figs, 1 tab.

6137 (INDC(NDS)–220, pp. 65-80) **$\nu(m^*)$ measurement for thermal neutron-induced fission of ^{233}U and ^{235}U by double-velocity double-energy method.** Nakagome, Y. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.); Kanno, I.; Kimura, I. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

Number of prompt neutrons as a function of individual fragment mass $\nu(m^*)$ was measured for the thermal neutron-induced fission of ^{233}U and ^{235}U. By measuring the velocities and energies of two fission fragments simultaneously, preneutron-emission fragment mass m^* and postneutron-emission fragment mass m were obtained. $\nu(m^*)$ was deduced by subtracting m from m^*. The fragment velocity was measured by a time-of-flight (TOF) method, and the start time was detected by a very thin plastic scintillator film detector. A silicon surface barrier detector was used to measure the fragment energy, which was also used as a stop detector of the TOF. The result of $\nu(m^*)$ for $^{233}U(n,f)$ was in agreement with other data in the heavy fragment region, but was 20 to 50% larger than those in the light one. $\nu(m^*)$ for $^{235}U(n,f)$ showed a factor of 1.5 to 2 larger in the light fragment region and smaller in the heavy one than the other data. With the energy balance equation, the total kinetic energy was estimated using the $\nu(m^*)$-value and was in good agreement with the experimental result. Also using the energy balance equation, the $\nu(m^*)$-values were calculated by assuming the thermal equilibrium at the scission point. These values were quite different from the experimental results in both cases. (author). 17 refs, 9 figs, 1 tab.

6138 (INDC(NDS)–220, pp. 93-98) **Neutron multiplicity of U-238 spontaneous fission.** Huang Shengnian (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy); Chen Jinggui; Han Hongyin. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

The neutron multiplicity distribution of U-238 spontaneous fission was measured using a large liquid scintillation neutron detector. 5 refs, 1 fig., 5 tabs.

6139 (INDC(NDS)–220, pp. 99-111) **Neutron gamma competition in fast fission.** Frehaut, J. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France). Service de Physique et Techniques Nucleaires). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

In the present paper we analyse the data we have obtained on the distribution of the gamma-ray energy per fission, as well as on the average energy E-bar$_\gamma$ released per fission for the neutron induced fission of several isotopes, in the energy range up to 15 MeV. 6 refs, 9 figs.

6140 (INDC(NDS)–220, pp. 113-122) **Neutron and gamma-ray emission in Cf-252 ternary fission.** Han Hongyin (Academia Sinica, Beijing, BJ (China). Inst. of Atomic Energy); Huang Shengnian; Meng Jiangchen; Bao Zongyu; Ye Zongyuan. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

We measured both the neutron and γ-ray yields in the ternary fission of Cf-252, with particle identification, to search for any possible evidence of neutron and γ-ray competition. 6 refs, 7 figs.

6141 (INDC(NDS)–220, pp. 123) **ν-bar$_p$ for neutron-induced fission in resonance region: Spin and (n, γf) reaction effects.** Fort, E. (CEA Centre d'Etudes Nucleaires de Cadarache, 13 - Saint-Paul-lez-Durance (France)); Long, P.; Frehaut, J.; Tellier, H. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

The average number of prompt neutrons ν-bar$_p$ emitted per fission event has been evaluated for ^{239}Pu with a special regard to the fluctuations experimentally observed in the low energy range. These fluctuations are demonstrated to have a significant impact for the applications especially the reactivity coefficient of advanced water reactors. Consequently, the ν-bar$_p$ curve has to be defined in the same fine energy mesh as the fission cross-section for accurate neutron source calculations. In this range formalisms are proposed to calculate ν-bar$_p$ from the resonance parameters, resolved or averaged. Using JEF1 library as a data base the analysis of several thermal, low moderated or fast systems shows a good convergence of the selected microscopic and integral informations. In the present evaluation the importance of the spin and (n, γf) effects in the generation of dips in the ν-bar$_p$ curve is emphasized. These effects which exist in the low energy range up to about 10 keV lead to a reduction of the effective value of ν-bar$_p$. Predominant in the epithermal range, the spin effect progressively decreases and the reduction of ν-bar$_p$ is due to the (n, γf) effect only in the keV region. (author).

6142 (INDC(NDS)–220, pp. 125-128) **Comment on spin dependence of ν-bar$_p$ in the resonance region for ^{239}Pu.** Walsh, R.L. (Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia)). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

The data discrepancy in the spin dependence of ν-bar$_p$ and E-bar$_K$ for ^{239}Pu above and below 1eV is discussed in relation to recent multichannel, multilevel cross section analysis of other authors. It is shown that the data discrepancy still exists, but that it is reduced in size. (author). 15 refs, 1 fig., 1 tab.

6143 (INDC(NDS)–220, pp. 129-138) **Interpretation of fluctuations of ν and E$_\gamma$ in resonances of ^{235}U(n,f).** Hambsch, F.J. (Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements); Knitter, H.H.; Budtz-Joergensen, C.; Theobald, J.P. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

Fluctuations of ν and E$_\gamma$ in resonances of ^{235}U(n,f) were measured in earlier experiments. Recently fission fragment mass- and total kinetic energy distributions of ^{235}U(n,f) were determined for single isolated resonances, resonance groups and energy bins in the energy range from 0.006 eV to 130 eV in an experiment at GELINA. Fluctuations of the symmetric fission fragment yield and of the asymmetric fragment peak shapes were observed. These fluctuations are interpreted as fluctuations of fission exit channel populations: by the superlong symmetric and the two asymmetric standard I and standard II exit channel populations. Mainly the fluctuations in the standard I and the standard II exit channels cause variations in the average reaction <Q>E$_i$-values. Correlated with the fluctuations of the mass yields in the asymmetric mass peaks also strong fluctuations of the total kinetic energy averaged over all fragments <TKE>E$_i$ are observed, which are anti-correlated with νE$_i$, the number of promptly emitted neutrons. It is explained, contrary to earlier assumptions, why the asymmetric and not the symmetric fission fragment yield fluctuations cause the fluctuations in ν and E$_\gamma$ from resonance to resonance. It can also be concluded that the ν-fluctuations are not J-dependent. (author). 19 refs, 4 figs.

6144 (INDC(NDS)–220, pp. 139-145) **Mass distribution structures as a function of excitation energy of the ^{252}Cf spontaneous fission fragments.** Alkhazov, I.D. (Radievyj Inst., Leningrad (USSR)); Kuznetsov, A.V.; Kovalenko, S.S.; Petrov, B.F.; Shpakov, V.I. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

Structures with a period of 5 amu were found in the fragment mass distributions in the ^{252}Cf spontaneous fission. The structures were observed for both the maximal and minimal fragment excitation energies as well as for the most asymmetric excitation energy partition between the fragments. (author). 10 refs, 4 figs.

6145 (INDC(NDS)–220, pp. 149-159) **Fission spectrum measurement of ^{232}Th and ^{238}U for 2 MeV neutrons.** Baba, M. (Tohoku Univ., Sendai (Japan). Dept. of Nuclear Engineering); Wakabayashi, H.; Ishikawa, M.; Nakashima, N.; Ito, N.; Hirakawa, N. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

Prompt fission neutron spectrum for 2-MeV neutron induced fission was measured for ^{232}Th and ^{238}U using a time-of-flight technique and solid samples as fission source. The fission neutron spectra were obtained from 2 MeV to 10 MeV for Th and to 12 MeV for U. The parameters for Maxwellian and Watt type distribution functions that fitted the experimental spectra were deduced using a least squares technique, whereas neither of them interprets all-over the experimental spectrum. The Maxwellian temperatures obtained by the fitting were in agreement with those expected from the number of prompt neutrons per fission according to Terrell or Howerton and Doyas's formula. Typical results are shown as well for double-differential neutron emission spectra of thorium and uranium for 14.1 MeV neutrons. These data, especially at backward angle, will be useful in test of models for neutron emission in multiple-chance fission. (author). 14 refs, 9 figs.

6146 (INDC(NDS)–220, pp. 161-168) **Energy and angular distribution of neutron emission in the spontaneous fission of ^{252}Cf.** Maerten, H. (Technische Univ., Dresden (German Democratic Republic)); Richter, D.; Seeliger, D.; Neubert, W.; Lajtai, A. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan),

24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

A new experimental method has been applied to measure the double-differential emission probability of Cf fission neutrons between 100 keV and 10 MeV. The neutron-fragment correlation experiment has been based on neutron time-of-flight spectroscopy combined with a direction-sensitive method of fragment spectroscopy. The angular distributions obtained cover the whole range from 0 to π. Results are presented and discussed in comparison with previous data. (author). 10 refs, 6 figs, 1 tab.

6147 (INDC(NDS)–220, pp. 169-170) **Neutron spectrum from neutron-induced fission of ^{232}Th.** Maerten, H. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik); Richter, D.; Ruben, A.; Seeliger, D.; Lovchikova, G.N.; Sukhikh, S.E.; Trufanov, A.M. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

The prompt neutron spectrum from ^{232}Th fission induced by 7.3-MeV neutrons has been measured at the Rossendorf tandem facility by the use of a multi-plate fission chamber in conjunction with the three-dimensional-data analysis of neutron time-of-flight, scintillator (NE 213) light output and pulse shape amplitude (n/γ-discrimination). 4 refs, 2 figs.

6148 (INDC(NDS)–220, pp. 171-173) **Differential neutron-emission cross-sections of ^{238}U bombarded with 14 MeV neutrons.** Elfruth, T. (Technische Univ., Dresden (German Democratic Republic). Sektion Physik); Hehl, T.; Kalka, H.; Maerten, H.; Ruben, A.; Seeliger, D.; Seidel, K.; Unholzer, S. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

Angle-integrated neutron emission spectrum from ^{238}U bombarded with 14.1 MeV neutrons was measured using an improved time-of-flight spectrometer. The experimental data have been compared with the calculated spectrum taking into account all competing reaction channels. 8 refs, 1 fig.

6149 (INDC(NDS)–220, pp. 175-179) **New evaluation of our absolute measurements of ^{252}Cf prompt fission neutron spectrum in the low energy range.** Lajtai, A. (Hungarian Academy of Sciences, Budapest (Hungary). Central Research Inst. for Physics); Dyachenko, P.P.; Seregina, E.A.; Kononov, V.N. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

Low energy californium neutron spectrum data have been determined utilizing new, refined neutron detector efficiency values. The efficiency of the neutron detector - a 0.95 cm thick NE-912 glass detector - was determined independently by using a 0.0835 cm thin glass detector as a reference, the efficiency of the latter being determined by a Monte Carlo calculation. The more precise repetition of this calculation taking into account the effects of all constituent elements resulted in more accurate efficiency data. The use of these new values in determining the efficiency of the thick neutron detector leads to quite considerable changes in data compared with those of the earlier evaluations. The paper contains the new efficiency data for the thick ^{6}Li glass detector and the californium neutron spectrum evaluated by them. This spectrum can be well described by the complex evaporation model spectrum calculated by Marten. (author). 10 refs, 2 figs, 1 tab.

6150 (INDC(NDS)–220, pp. 181-206) **Simultaneous investigation of fission fragments and neutrons in ^{252}Cf (SF).** Budtz-Joergensen, C. (Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements); Knitter, H.H. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

The gridded twin ionization chamber developed at CBNM is used to measure the kinetic energy-, mass- and angular distributions of the fission fragments of the spontaneous fission of ^{252}Cf. Together with a neutron time-of-flight detector this experimental arrangement permits to measure the correlations between neutron emission, fragment angle, mass and energy of the fission fragments. Without neutron coincidences 40center dot10^{6} fission events were recorded which are evaluated to give mass, total kinetic energy and the variance distributions in a broad mass range from mass 67 to 185. About 3center dot10^{6} fission events were recorded in coincidence with a neutron detected in the time-of-flight detector. Angular distributions in the CM-system revealed isotropy in the whole fission neutron energy range. This permits the conclusion that fission neutrons are emitted from the fully accelerated fragments and that the hitherto assumed scission neutron component of 15 to 20% is much smaller, as can be determined from the uncertainty of the second Legendre polynomial coefficient. The average number of neutrons was determined as function of fragment mass and TKE. The mass range for ν-bar(A) was extended beyond that of earlier measurements and revealed two new sawteeth near masses 80 and 176. The slopes and end points of ν-bar(TKE) were also determined for each fragment mass. The fragment centre-of-mass fission neutron spectra were determined as function of fragment mass and TKE. These spectra permitted the evaluation of the average neutron energy eta-bar(A,TKE) the nuclear temperature T(A,TKE) and the λ-factor from the cascade evaporation model. These quantities permitted the evaluation of the level density parameter α(A) in the mass range from 90 to 169. (author). 27 refs, 19 figs.

6151 (INDC(NDS)–220, pp. 207-219) **Emission energy spectra of neutrons from spontaneous fission fragments.** Batenkov, O.I. (Radievyj Inst., Leningrad (USSR)); Blinov, A.B.; Blinov, M.V.; Smirnov, S.N. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

Multiparameter precision measurements of differential energy spectra of ^{252}Cf spontaneous fission neutrons have been carried out for different masses, kinetic energies and excitation energies of the fragments at different emission angles. These data have been analysed on the assumption of the evaporation model. The dependence of the average neutron energies have been studied for different masses and the fragments' total kinetic energies. Average energies of the neutrons emitted by spontaneous fission fragments have been compared with those of the neutrons from nuclear reactions. (author). 23 refs, 8 figs.

6152 (INDC(NDS)–220, pp. 305-336) **Status of the Cf-252 fission neutron spectrum evaluation with regard to recent experiments.** Mannhart, W. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.)). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

A summary of the present status and future development of the evaluation of the neutron spectrum of spontaneous fission of Cf-252 is given. The experimental data base has been critically analysed to identify new and revised experiments. Both theoretical and semi-empirical descriptions of this neutron spectrum are discussed and reviewed. (author). 36 refs, 15 figs, 2 tabs.

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Refer also to citation(s) 6019, 6101, 6126, 6139, 6141

6153 (CONF-8909268–1) **Status of theories for calculations of production cross sections of long-lived radionuclides.** Fu, C.Y. Oak Ridge National Lab., TN (USA). [1989]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From IAEA consultants' meeting on cross sections for the generation of long-lived radionuclides; Argonne, IL (USA); 13-14 Sep 1989. Order Number DE90003073. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The theories discussed in this paper are confined to those currently being used or considered for the calculation of activation cross sections. The theories are the same regardless of whether the activation product is long lived or short lived. However, the cross sections for the generation of long-lived radionuclides are more difficult or expensive to measure, hence there are fewer data available and the requirement on the predictive capability of the theories used is more stringent. It is clear from other papers presented in this meeting and the adjoining NEANDC specialists' meeting on activation cross sections that the nuclear theories of interest to this group are those used or needed in modern Hauser-Feshbach (H-F) codes with pre-equilibrium correction and gamma-ray cascades. The H-F formalism is indispensable due to the sensitivity of the calculated results, especially isomeric ratios, to the spins and parities of the discrete levels as well as to the spin distributions in the total and exciton level densities. Topics included in this paper are the optical model, gamma-ray strength function, total and exciton level-density theories, and the pre-compound model. In each subject, we describe the most commonly used theories first, followed by relatively new developments that are used in at least one model code or the promising theories that do not appear to require a large effort for incorporation into existing H-F codes. 14 refs.

6154 (CONF-8911128–1) **Pairing interaction effects in exciton level densities.** Fu, C.Y. Oak Ridge National Lab., TN (USA). [1989]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From NEANDC specialists' meeting on level densities; Bologna (Italy); 15-17 Nov 1989. Order Number DE90003074. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Recent progress in pairing corrections for exciton state-density formulas used in pre-compound nuclear reaction theories is reviewed. These correction factors are, strictly speaking, dependent on the nuclear excitation energy U and the exciton number n. A simple formula for (U,n)-dependent pairing corrections has been derived, based on the BCS pairing equations for constant single-particle spacing, for the exciton state-density formula for one kind of Fermion. It has been shown that the constant-pairing-energy correction used in standard state-density formulas, such U_0 in Gilbert and Cameron, is a limiting case of the general (U,n)-dependent results. Spin cutoff factors with pairing effects were also obtained using the same theory and parameterized into an explicit (U,n)-dependent function, thereby defining a simple exciton level-density formula for applications in quantum mechanical precompound theories. Preliminary results from extending such simple pairing-interaction representations to level-density formulas for two kinds of Fermions are summarized. The results show that the ratios in the exciton level densities in the one-Fermion and two-Fermion approaches vary with both U and n, thus likely leading to differences in calculated compound to precompound ratios. However, the differences in the spin cutoff factors in the two cases are found to be rather small. 12 refs., 3 figs.

6155 (CONF-8911128–2) **Applied uses of level density models.** Arthur, E.D. (Los Alamos National Lab., NM (USA)); Guenther, P.T.; Smith, A.B.; Smith, D.L. Argonne National Lab., IL (USA). [1989]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38;W-7405-ENG-36. From NEANDC specialists' meeting on level densities; Bologna (Italy); 15-17 Nov 1989. Order Number DE90003783. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This paper addresses issues associated with the use of nuclear level density models in calculations made for data applications. The two most commonly used models, the Gilbert Cameron and the Back-Shifted Fermi Gas, are briefly summarized and examples are provided of recent efforts to improve their parameterization. Calculated particle emission spectra are compared with recent experimental data in order to assess performance and sensitivity to these models. Extrapolation of nuclear level densities for calculations involving nuclei away from stability poses special problems and examples of recent efforts to improve such extrapolations are cited. The sensitivity of current schemes in the modeling of fission transition state densities are explored through calculated (n,f) cross sections. Two newer phenomenological models, those of Ignatyuk and Schmidt, provide a more physically realistic description of level densities. Calculations concerning ^{207}Pb(n,xn) cross sections compare results using the Ignatyuk formalism with the Gilbert Cameron results. 31 refs., 10 figs.

6156 (CONF-8911128–3) **1989 report on the IAEA research agreement No.4412/CF.** Guenther, P.T. Argonne National Lab., IL (USA). [1989]. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From NEANDC specialists' meeting on level densities; Bologna (Italy); 15-17 Nov 1989. Order Number DE90003776. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

My contribution to this CRP is the provision of double-differential neutron-scattering cross section data on the mono-isotopic elements Nb, Rh, In, Ho, Ta, Au, and Bi. These data cover the ranges incident neutron energies, E_{in} = 5–8 Mev, angular range, 30–158 °, excitation energies, ≈ 2 to E_{in}–1 MeV. In this report I will briefly review the original purpose of these measurements, indicate the assumptions and procedures required to obtain the requested cross sections, present the results of this effort, give a few examples of how these results compare to calculations made with relevant nuclear model codes, describe the data files that I have prepared for the participants of this CRP, briefly describe sources of error. An appendix contains a short discussion of some experimental concerns. 8 refs., 9 figs.

6157 (DOE/ER/40251–4) **Theoretical interpretation of data from high-energy nuclear collisions: Progress report, January 1, 1989–September 30, 1989.** Fai, G. Kent State Univ., OH (USA). Dept. of Physics. Sep 1988. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER40251. Order Number DE90003448. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Nuclear collision data at energies ranging from medium to relativistic are interpreted theoretically. The major objective is a better understanding of high-energy heavy-ion collisions, with particular emphasis on the properties of excited nuclear matter. Further progress towards a satisfactory description of excited subsaturation nuclear matter is achieved. The mean free path of a nucleon in nuclear matter, which is a critical parameter in assessing the applicability of certain nuclear collision models, is investigated. Experimental information is used together with theoretical concepts in collaborations with experimentalists in order to learn about the reaction mechanism and about excited nuclear matter properties. In the framework of a more strictly theoretical program development, subnuclear degrees of freedom and nonlinear phenomena in model field theories are studied.

6158 (IC–89/91) **Present status of the EMC effect.** Modarres, M.; Ghafoori-Tabrizi, K. International Centre for Theoretical Physics, Trieste (Italy). Jun 1989. 19p. Order Number DE90610701. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In this paper we intend to analyze the recent experimental and theoretical aspects of nucleus structure functions. We will also demonstrate that various types of nucleon distribution functions do not have significant effect on the EMC ratio. Finally, we conclude that the "traditional" nuclear physics is still working well and quark

and gluonic degrees of freedom will only have a small effect on "nuclear physics" results. (author). 26 refs, 11 figs.

6159 (IC–89/229) **Study of multiplicity in nucleus-nucleus collisions a test for KNO scaling.** Ojha, I.D. (International Centre for Theoretical Physics, Trieste (Italy)); Srinivasarao, P.V.S.S.S.; Tuli, S.K. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 9p. Order Number DE90610714. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

An attempt has been made to study the scaling behaviour of shower particles produced in nucleus-nucleus collisions in the context of KNO scaling assumption. Various multiplicity moments, C_q, are calculated. There is serious doubt about the validity of scaling over the entire region of collision geometry. (author). 6 refs, 3 tabs, 2 figs.

6160 (IC–89/279) **Pion-nucleus scattering around the (3,3) resonance.** Rahman, M.A. (Dacca Univ. (Bangladesh). Dept. of Physics); Sen Gupta, H.M.; Rahman, M. International Centre for Theoretical Physics, Trieste (Italy). Sep 1989. 20p. Order Number DE90610715. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Elastic scattering of π^{+-} are studied on ^{28}Si, ^{40}Ar, ^{40,48}Ca, ^{90}Zr and ^{208}Pb at energies around the (3,3) resonance within the framework of the strong absorption model of Frahn and Venter. The parameters thus obtained are used in the analysis of the inelastic scattering of pions leading to the lowest 2^{+-} state in ^{28}Si. A reasonably good account of the scattering processes (elastic and inelastic) is given by the simple model. (author). 13 refs, 8 figs, 3 tabs.

6161 (INDC(NDS)–220, pp. 21-45) **Energy dependence of ν-bar$_p$.** Boldeman, J.W. (Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia)). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

This review considers firstly, the basic reference data for the measurement of ν-bar and then the problems in energy dependence of ν-bar$_p$. Finally, the theoretical implications of the measured dependence of ν-bar$_p$ are discussed. 46 refs, 16 figs, 2 tabs.

6162 (INDC(NDS)–220, pp. 47-57) **Fission energetics and prompt neutron emission.** Maerten, H. (Technische Univ., Dresden (German Democratic Republic)); Ruben, A.; Seeliger, D. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

Energy partition in nuclear fission is studied as function of mass asymmetry A_1/A_2 in the framework of a scission point model (two-spheroid model TSM) including semi-empirical, temperature-dependent shell correction energies $\delta W(A)$. Average total kinetic energies TKE-bar(A_1/A_2) calculated within TSM agree with experimental data. Based on average excitation energies of the fragments E-bar$_i$*(A) neutron multiplicities ν-bar(A) are deduced. The TSM, which is applicable to any fission reactions in the (Th-Cf) region for excitation energies of the fissioning nucleus lower than about 30 MeV, reproduces known trends of experimental data on TKE-bar and ν-bar. (author). 27 refs, 10 figs.

6163 (INDC(NDS)–220, pp. 82-92) **Neutron multiplicity distribution in fast neutron-induced fission.** Frehaut, J. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France). Service de Physique et Techniques Nucleaires). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

The magnitude of the fission neutron multiplicity distribution variances is calculated taking into account the distribution of excitation energy, the energy spectrum of the emitted neutrons and the neutron-gamma competition. The energy dependence of the variances is quite well reproduced. 8 refs, 4 figs, 3 tabs.

6164 (INDC(NDS)–220, pp. 221-240) **What can be learnt about neutron emission mechanism in fission from heavy ion induced fission studies.** Kapoor, S.S. (Bhabha Atomic Research Centre, Bombay (India)). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

In this paper we present a review of some of the recent results on neutron emission in heavy ion induced fission. The main conclusion is that the fission dynamics and in particular the motion from saddle to scission is highly dissipative. 24 refs, 8 figs, 3 tabs.

6165 (INDC(NDS)–220, pp. 241-244) **Prescission neutron emission in thermal neutron fission of ^{235}U.** Choudhury, R.K. (Bhabha Atomic Research Centre, Bombay (India). Nuclear Physics Div.); Kapoor, S.S. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

We calculated the neutron anisotropy for thermal neutron fission of ^{235}U and from the comparison with the experimental one the fraction of prescission neutrons as a function of total kinetic energy of fragments is deduced. 1 fig.

6166 (INDC(NDS)–220, pp. 245-258) **Theory of prompt fission neutron emission.** Maerten, H. (Technische Univ., Dresden (German Democratic Republic)); Ruben, A.; Seeliger, D. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

Basic requirements to be met for the physically consistent calculation of energy and angular distributions of prompt fission neutrons are summarized. Main emphasis is pointed to an adequate statistical-model approach (SMA) to cascade neutron evaporation from a fragment diversity specified by the occurrence probability $P(p_f)$ as function of a fragment parameter set p_f ("internal" consistency) as well as to the SMA application to any fission reaction depending on the $P(p_f)$-description as function of the fissioning-nucleus parameters p_{FN} ("external" consistency). (author). 30 refs, 13 figs.

6167 (INDC(NDS)–220, pp. 259-281) **Recent improvements in the calculation of prompt fission neutron spectra: Preliminary results.** Madland, D.G. (Los Alamos National Lab., NM (USA). Theoretical Div.); LaBauve, R.J.; Nix, J.R. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

We consider three topics in the refinement and improvement of our original calculations of prompt fission neutron spectra. These are an improved calculation of the prompt fission neutron spectrum

N(E) from the spontaneous fission of ^{252}Cf, a complete calculation of the prompt fission neutron spectrum matrix $N(E,E_n)$ from the neutron-induced fission of ^{235}U, at incident neutron energies ranging from 0 to 15 MeV, and an assessment of the scission neutron component of the prompt fission neutron spectrum. Preliminary results will be presented and compared with experimental measurements and an evaluation. A suggestion is made for new integral cross section measurements. (author). 45 refs, 12 figs, 1 tab.

6168 (INDC(NDS)–220, pp. 283-298) **Differential and integral characteristics of prompt fission neutrons in the statistical theory.** Gerasimenko, B.F. (Radievyj Inst., Leningrad (USSR)); Rubchenya, V.A. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

Hauser-Feshbach statistical theory is the most consistent approach to the calculation of both spectra and prompt fission neutrons characteristics. On the basis of this approach a statistical model for calculation of differential prompt fission neutrons characteristics of low energy fission has been proposed and improved in order to take into account the anisotropy effects arising at prompt fission neutrons emission from fragments. 37 refs, 6 figs.

6169 (INDC(NDS)–220, pp. 299-303) **Calculation of fission neutron spectrum with incorporation of pre-acceleration neutron emission.** Walsh, R.L. (Australian Nuclear Science and Technology Organisation, Lucas Heights (Australia)); Chircu, G. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Jun 1989. (CONF-8805174–: IAEA consultants' meeting on the physics of neutron emission in fission, Mito (Japan), 24-27 May 1988). In *Physics of neutron emission in fission. Proceedings of a consultants meeting held in Mito City, Japan, 24-27 May 1988.* Order Number DE90607759. Available from NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS.

We have incorporated a component of pre-acceleration neutron emission into our calculation of the fission neutron spectrum of ^{252}Cf using the spin-dependent Madland-Nix Model. The calculation now gives good agreement with the data in the low energy region below 0.5 MeV. (author). 21 refs, 3 figs.

6170 (INDC(NDS)–223/GF, pp. 220-222) **Some notes on the calculation of energy-angle correlated distributions with TNG and their representation in File 6 formats.** Larson, D.C. (Oak Ridge National Lab., TN (USA)); Fu, C.Y.; Hetrick, D.M. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8711217–: IAEA Specialists' meeting on the Fusion Evaluated Nuclear Data Library related to the ITER activity, Vienna (Austria), 16-18 Nov 1987). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The model code TNG has been extensively used in evaluation work of structural materials for ENDF/B-VI performed at Oak Ridge National Laboratory. A new aspect of ENDF/B-VI is the use of File 6 formats for energy-angle correlated data. Such data are generally calculated, anchored by experimental data. In this informal note we outline how the TNG results are calculated and entered in the File 6 formats. (author). 4 refs.

6171 (INP–1307/PH) **Production and collective motion of qq-bar plasma in heavy ion collisions.** Bialas, A. (Uniwersytet Jagiellonski, Cracow (Poland). Inst. Fizyki); Czyz, W. Institute of Nuclear Physics, Cracow (Poland). 1986. 47p. Order Number DE90610708. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The Heinz transport equations for qq-bar plasma are generalized to include a term responsible for qq-bar tunneling from vacuum in chromoelectric field. They are used to study the time dependence of the particle and energy densities and other characteristics of qq-bar production in a color flux tube. The energy density larger than 4 GeV/fm^3 is found at the 'formation time' 0,3 fm for a tube five times stronger than the elementary one. The oscillations of the system survive the damping effects brought about by the process of production of qq-bar pairs. 22 refs., 9 figs. (author).

6172 (INP–1308/PL) **Diffraction in nuclear scattering.** Wojciechowski, H. Institute of Nuclear Physics, Cracow (Poland). 1986. 20p. Order Number DE90610716. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The elastic scattering amplitudes for charged and neutral particles have been decomposed into diffractive and refractive parts by splitting the nuclear elastic scattering matrix elements into components responsible for these effects. It has been shown that the pure geometrical diffractive effect which carries no information about the nuclear interaction is always predominant at forward angle of elastic angular distributions. This fact suggests that for strongly absorbed particles only elastic cross section at backward angles, i.e. the refractive cross section, can give us basic information about the central nuclear potential. 12 refs., 4 figs., 1 tab. (author).

6173 (INP–1311/PH) **Kinetic coefficients for quark-antiquark plasma.** Czyz, W. (Institute of Nuclear Physics, Cracow (Poland)); Florkowski, W. Institute of Nuclear Physics, Cracow (Poland). Mar 1986. 41p. Order Number DE90610709. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The quark-antiquark plasma near equilibrium is studied. The results are based on the Heinz kinetic equations with the Boltzmann collision operator approximated by a relaxation term with the relaxation time, tau, treated as a small parameter. Linear in tau solutions of these equations are used to calculate the transport coefficients: the non-abelian version of Ohm's law, and the shear and volume viscosities. We introduce new chemical potentials which determine the color density matrix of quarks (antiquarks). Gradients of these potentials generate color currents. 12 refs. (author).

6174 (LBL–27690) **Physics with nuclei at high energies.** Geist, W.M. Lawrence Berkeley Lab., CA (USA). Aug 1989. 24p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8903175–2: Recontre de Moriond conference, Les Arcs (France), 12-17 Mar 1989). Order Number DE90003939. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Physics with nuclei at high energy is not reducible to a superposition of interactions involving individual nucleons; rather, qualitatively new phenomena show up. This is what one concludes from recent data on dilepton production off nuclei and on elastic proton-nucleus scattering. Furthermore, recent analyses of ion collisions at BNL and CERN reveal a number of non-conventional features. The relevant contributions to this Rencontre are summarized here. 37 refs., 16 figs.

6175 (ORNL/FTR–3489) **[Nuclear level densities]: Foreign trip report, November 12–November 20, 1989.** Fu, C.Y. Oak Ridge National Lab., TN (USA). 28 Nov 1989. 20p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90003628. Available from NTIS, PC A03/MF A01 - OSTI.

The traveler was invited to the NEANDC meeting to present a paper on the pairing interaction effects on exciton level densities. The paper contains a review on the subject in the one-Fermion formulation and a summary of the traveler's current research in the two-Fermion case. The research is intended to be used in the nuclear model code TNG, developed as part of an ORNL project on nuclear data for fission and fusion. Highlights of the meeting and of the discussions with Ignatyuk are reported.

6176 (OUP–88-21) **Oscillator strengths and lifetimes for low-lying terms in the Al isoelectronic sequence.** Hjort-Jensen, M. (Norges Tekniske Hoegskole, Trondheim (Norway). Inst. for Teoretisk Fysikk); Aashamar, K. Oslo Univ. (Norway). Fysisk Inst. Nov 1988. 32p. Order Number DE90609265. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Using the Multiconfiguration Optimized Potential Model, calculations of oscillator strengths in the length, and velocity formulation for a large number of transitions in the Aluminium isoelectronic sequence from Si II through K VII, have been performed. The results

have been used to determine the lifetimes of 14 low-lying excited terms along the sequence. Comparison is made with experiment and with other theory where results are available. The agreement between the obtained values and other theoretical results is generally good, although deviations do occur near level crossings. Some significant discrepancies between theory and experiment persist concerning lifetimes for S IV. 45 refs.

6177 (USIP–89-03) **Nuclear molecular structure in heavy mass systems.** Arctaedius, T. (Stockholm Univ. (Sweden). Dept. of Physics); Bargholtz, C. Stockholm Univ. (Sweden). Inst. of Physics. Apr 1989. 20p. Order Number DE90610720. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A study is made of nuclear molecular configurations involving one heavy mass partner. The stability of these configurations to mass flow and to fission is investigated as well as their population in fusion reactions. It is concluded that shell effects in combination with the effects of angular momentum may be important in stabilizing certain configurations. A possible relation of these configurations to the so called superdeformed states is pointed out. The spectrum of rotational and vibrational trasitions within molecular configurations is investigated. For sufficiently mass-asymmetric systems the engergies of vibrational transitions are comparable to the neutron separation energy. Gamma radiation from such transitions may then be observable above the background of statistical transitions. The gamma spectrum and the directional distribution of the radioation following fusion reactions with ^{12}C and ^{16}O are calculated. (authors).

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Refer also to citation(s) 5153, 5154, 5156, 5157, 5210, 5770, 6129, 6349, 6365, 6400

6178 (INDC(CCP)–301/GF, pp. 15-20) **Neutron leakage spectra from Be, Pb and U spheres at 14 MeV energy.** Androsenko, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Androsenko, P.A.; Devkin, B.V. and others. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. Jul 1989. (CONF-870959–: 1. international conference on neutron physics, Kiev (USSR), 14-18 Sep 1987). In *Translations from Russian publications of proceedings of the international conference on neutron physics, Kiev, 14-18 September 1987.* Order Number DE90607489. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Experimental data on neutron leakage spectra from beryllium, lead and uranium spheres with a central 14 MeV neutron source using a time-of-flight spectrometer have been measured. The data were compared with those calculated with the BLANK code using different nuclear data files. 15 refs, 1 fig., 2 tabs.

6179 (INDC(NDS)–223/GF, pp. 85-90) **Analytical results on IAEA benchmark problem based on TUD Pb sphere experiment.** Maekawa, Hiroshi (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan)); Kosako, Kazuaki; Suzuki, Tomoo; Hasegawa, Akira. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8905244–: IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna (Austria), 8-11 May 1989). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The analytical results on IAEA Benchmark Problem based on TUD Pb sphere experiment using the transport codes ANISN-JR and BERMUDA-1DN are presented.

6180 (INDC(NDS)–223/GF, pp. 91-94) **Preliminary result of time-of-flight experiment on lead slabs.** Maekawa, Hiroski (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan)); Oyama, Yukio; Yamaguchi, Seiya. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8905244–: IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna (Austria), 8-11 May 1989). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

Angular neutron flux spectra from Pb slabs have been obtained as benchmark data for integral test and to check nuclear data of Pb.

6181 (INDC(NDS)–223/GF, pp. 95-104) **Benchmark calculations on a lead sphere.** Yamamoto, Junji (Osaka Univ., Suita (Japan). Faculty of Engineering); Sumita, Kenji. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8905244–: IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna (Austria), 8-11 May 1989). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The results of benchmark calculations on a lead sphere are compared with TUD experimental data for partial and total neutron multiplications, neutron leakage spectra and activation rates. 11 figs.

6182 (INDC(NDS)–223/GF, pp. 105-115) **Lead sphere benchmark calculations.** Fischer, U. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.)); Schwenk-Ferrero, A.; Wiegner, E. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8905244–: IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna (Austria), 8-11 May 1989). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The results of Dresden lead sphere experiment and Osaka lead sphere experiment for neutron multiplication and neutron leakage current are compared with the results of different calculation procedures. 2 tabs, figs.

6183 (INDC(NDS)–223/GF, pp. 138-150) **Neutron multiplication in lead in the experiments with neutron generators.** Markovskij, D.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8905244–: IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna (Austria), 8-11 May 1989). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

A calculational analysis of neutron multiplication in lead, including the estimates of multiplication limits for the standard ENDF/BIV data set and the effects of various changes in the data themselves is performed. 10 refs, 5 figs.

6184 (INDC(NDS)–223/GF, pp. 151-160) **Calculation of spherical models of lead with a source of 14 MeV-neutrons.** Markovskij, D.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Borisov, A.A. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8905244–: IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna (Austria), 8-11 May 1989). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

Neutron transport calculations for spherical models of lead have been done with the one-dimensional code BLANK realizing the direct Monte Carlo method in the whole range of neutron energies and they are compared with the experimental results. 6 refs, 10 figs, 3 tabs.

6185 (INDC(NDS)–223/GF, pp. 161-167) **Results for IAEA sponsored international benchmark on 22.5 cm thick spherical lead shell.** Kumar, A. (California Univ., Los Angeles, CA (USA)). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8905244–: IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna (Austria), 8-11 May 1989). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The results of the IAEA sponsored International Benchmark on 22.5 cm Thick Spherical Lead Shell are presented for: partial and total multiplications per source neutron and nucleus; neutron leakage spectrum per unit lethargy per source neutron; activation rates per source neutron and nucleus; fission rates per source neutron and nucleus. 4 tabs.

6186 (INDC(NDS)–223/GF, pp. 168-178) **TUD-Pb calculational benchmark with 14 MeV neutrons.** Antonov, S. (Bylgarska Akademiya na Naukite, Sofia (Bulgaria). Inst. za Yadrena Izsledvaniya i Yadrena Energetika); Ilieva, K.; Jordanova, J.; Pavlova, K.; Popova, I. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8905244–: IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna (Austria), 8-11 May 1989). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The results for TUD lead sphere benchmark problem calculated by using ANISN, MCNP and MORSE transport codes and different cross section data are presented in this report. 12 refs, 2 figs, 5 tabs.

6187 (INDC(NDS)–224/GF, pp. 5-8) **Neutron leakages from Pb and Be spherical shells with a central 14-MeV neutron source.** Antonov, S. (Bylgarska Akademiya na Naukite, Sofia (Bulgaria). Inst. za Yadrena Izsledvaniya i Yadrena Energetika); Daskalov, G.; Ilieva, K.; Jordanova, J.; Prodanova, R.; Zagryadskij, V.A.; Novikov, V.M.; Chuvilin, D.Yu. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-870959–: 1. international conference on neutron physics, Kiev (USSR), 14-18 Sep 1987). In *Translation of reports from the first international conference on neutron physics, Kiev, USSR, 14-18 September 1987.* Order Number DE90607655. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Translated from Russian by the IAEA.

The paper presents the results of measurements of neutron leakages from lead and beryllium spherical shells of different thicknesses with a central 14-MeV neutron source. The experimental results are compared with calculations using the BLANK, ANISN and MORSE codes. 9 refs, 2 tabs.

6188 (INDC(NDS)–224/GF, pp. 9-12) **Integral experiment on transmission of 14-MeV neutrons in a FLiBe-assembly.** Antonov, S. (Bylgarska Akademiya na Naukite, Sofia (Bulgaria). Inst. za Yadrena Izsledvaniya i Yadrena Energetika); Daskalov, G.; Ilieva, K.; Panteleev, T.; Stoeva, L.; Khristov, V.; Zagryadskij, V.; Chuvilin, D. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-870959–: 1. international conference on neutron physics, Kiev (USSR), 14-18 Sep 1987). In *Translation of reports from the first international conference on neutron physics, Kiev, USSR, 14-18 September 1987.* Order Number DE90607655. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Translated from Russian by the IAEA.

Fluorine-lithium-beryllium assemblies are being considered as possible blanket materials for fusion reactors. In order to study the breeding properties of lithium and beryllium, the spectral indices for neutron leakages from a spherical assembly were measured and compared with model calculations. 4 refs, 3 tabs.

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Refer also to citation(s) 5028, 5191, 5713, 5732, 5733, 5785, 5831, 5879, 5902, 5941, 5942, 5945

6189 (CEGB-RD/B–6077/R88) **INDAR: a computer code for the calculation of critical group radiation exposure from routine discharges of radioactivity to seas and estuaries - description and users' guide.** Maul, P.R.; Wilmott, S. Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs. Dec 1988. 90p. (ODMWG/P–(88)9). Order Number DE90609933. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

The computer program INDAR enables detailed estimates to be made of critical group radiation exposure arising from routine discharges of radioactivity for coastal sites where the discharge is close to the shore and the shoreline is reasonably straight, and for estuarine sites where radioactivity is rapidly mixed across the width of the estuary. Important processes which can be taken into account include the turbulence generated by the discharge, the effects of a sloping sea bed and the variation with time of the lateral dispersion coefficient. The significance of the timing of discharges can also be assessed. INDAR uses physically meaningful hydrographic parameters directly. For most sites the most important exposure pathways are seafood consumption, external exposure over estuarine sediments and beaches, and the handling of fishing gear. As well as for these primary pathways, INDAR enables direct calculations to be made for some additional exposure pathways. The secondary pathways considered are seaweed consumption, swimming, the handling of materials other than fishing gear and the inhalation of activity. (author).

6190 (CNEN-NN–6.04) **Functioning of industrial radiography services.** Alves, R.N.; Costa, H.M. da; Bianchini, F.G.; Arrieta, L.A.I. Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil). Dept. de Normas e Especificacoes. Dec 1988. 42p. (In Portuguese). (DNE–37). Available from Centro de Informacoes Nucleares of the Comissao Nacional de Energia Nuclear, RJ, Brazil.

The objective of this norm is establish the necessary requirements for the functioning of industrial radiography services, as well as the procedures for acquisition and transfer of radioactive sources and/or X-ray equipments used in industrial radiography.

6191 (INIS-BR–1692, pp. 83-122) **Development of a mathematic phantom for a child with 10 years age for internal dosimetry.** Deus, S.F. (Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)); Poston, J.W.; Watanabe, S. Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. (In Portuguese). (CONF-8908184–: 3. meeting of the Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). In *Proceedings of the 3. Brazilian Congress of Physicists in Medicine.* Order Number DE90705978. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The main purpose of this research are: (1) develop the mathematic phantom project of a child with 10 years age and (2) use this phanton as calculation base of specific absorbed fractions in internal organs and in skeleton due to the radionuclides more used in nuclear medicine. The forescasting of specific absorbed fractions obtainment by the use of this phantom are compared with a more simple model, and the differences are also discussed. (C.G.C.).

6192 (INIS-BR–1692, pp. 123-133) **Dose calculation in brachytherapy with microcomputers.** Elbern, A.W. (Rio Grande do Sul Univ., Porto Alegre (Brazil). Dept. de Engenharia Nuclear). Associacao Brasileira de Fisicos em Medicina, Sao Paulo, SP (Brazil). 1989. (In Portuguese). (CONF-8908184–: 3. meeting of the Brazilian Congress of Physicists in Medicine, Aguas de Lindoia (Brazil), 23-26 Aug 1989). In *Proceedings of the 3. Brazilian Congress of Physicists in Medicine.* Order Number DE90705978. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The computer algorithms, that allow the calculation of brachytherapy doses and its graphic representation for implants, using programs developed for Pc microcomputers are presented. These algorithms allow to localized the sources in space, from their projection in radiographics images and trace isodose counter. (C.G.C.).

6193 (INIS-mf–11562, pp. 6l) **Application of personnel neutron dosimetry by UVVR in neutron fields of nuclear power plants. II. Neutron spectra calculation and analysis in nuclear power plants.** Prouza, Z. (Karlova Univ., Prague (Czechoslovakia). Fakulta Vseobecneho Lekarstvi); Hermanska, J.; Cerny, P.; Lieskovsky, M.; Moravek, J. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. NEUTRON SPECTRA/data processing; PERSONNEL DOSIMETRY/neutron dosimetry; DOSE EQUIVALENTS; FISSION FOIL DETECTORS; MODERATING DETECTORS; NUCLEAR POWER PLANTS

6194 (INIS-mf–11562, pp. 3) **Various methods of evalulating ^{131}I retention in thyroid glands following the Chernobyl accident.** Beno, M. (Vyskumny Ustav Preventivneho Lekarstva, Bratislava (Czechoslovakia)); Hrabovcova, A.; Piknova, D. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

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6195 (INIS-mf–11562, pp. 18) **Calculation of individual dose equivalents on Eastern Slovakia territory following the Chernobyl accident.** Hanusik, V. (Ustav Radioekologie a Vyuzitia Jadrovej Techniky, Kosice (Czechoslovakia)); Wirdzek, S. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

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6196 (INIS-mf–11562, pp. 27) **Estimate of thyroid gland load with ^{131}I using different calculation methods.** Hrabovcova, A. (Vyskumny Ustav Preventivneho Lekarstva, Bratislava (Czechoslovakia)); Beno, M.; Vladar, M. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. THYROID/iodine 131; CHERNOBYLSK-4 REACTOR; DATA PROCESSING; DOSE COMMITMENTS; INHALATION; MATHEMATICAL MODELS; RADIATION ACCIDENTS; THYROID

6197 (INIS-mf–11562, pp. 30) **Dose burden of children and youth in pre-school and school installations in Slovakia.** Kazimir, D. (Ustav Radioekologie a Vyuzitia Jadrovej Techniky, Kosice (Czechoslovakia)). Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. EDUCATIONAL FACILITIES/radon; RADON/buildings; ADOLESCENTS; CHILDREN; DAUGHTER PRODUCTS; DOSE RATES; RADON; IONIZATION CHAMBERS; RADIOACTIVITY; BUILDINGS

6198 (INIS-mf–11562, pp. 36) **Parametrization of depth dose curves for electron beams.** Kovar, I. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni). Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. ELECTRON BEAMS/depth dose distributions; ISODOSE CURVES; PHANTOMS; RADIATION DOSES

6199 (INIS-mf–11562, pp. 37) **Unfolding of mixed gamma spectrum into significant components by rotation in factor space.** Krnac, S. (Vyskumny Ustav Preventivneho Lekarstva, Bratislava (Czechoslovakia)). Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. GAMMA SPECTRA/data processing; CALIBRATION STANDARDS; DOSIMETRY; SEMICONDUCTOR DETECTORS

6200 (INIS-mf–11562, pp. 43) **Differences in radiation loads in stomach examination at selected radiodiagnostic departments.** Mikusova, M. (Institut pro Dalsi Vzdelavani Lekaru a Farmaceutu, Prague (Czechoslovakia)); Drabkova, A. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. BIOMEDICAL RADIOGRAPHY/dose equivalents; STOMACH/biomedical radiography; PATIENTS; RADIATION PROTECTION; STOMACH

6201 (INIS-mf–11562, pp. 46) **Radiation hygiene impact of transuranium actinides present in contaminants in A-1 nuclear power plant.** Minarik, F.; Fueloep, M.; Vladar, M.; Lahham, A.; Szlaurova, M.; Vano, S.; Soos, F. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. TRANSURANIUM ELEMENTS/radiation doses; BOHUNICE A-1 REACTOR; CONTAMINATION; LET; RADIATION HAZARDS; RADIOACTIVE AEROSOLS; RESPIRATORY SYSTEM

6202 (INIS-mf–11562, pp. 52) **Effect of phantom shape on personnel dosemeter response.** Nikodemova, D. (Vyskumny Ustav Preventivneho Lekarstva, Bratislava (Czechoslovakia)); Vicanova, M.; Hrabovcova, A. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. PHANTOMS/thermoluminescent dosemeters; THERMOLUMINESCENT DOSEMETERS/calibration; DOSE EQUIVALENTS; GAMMA RADIATION; LITHIUM FLUORIDES; NEUTRONS; PARAFFIN; PERSONNEL DOSIMETRY; PHANTOMS; POLYETHYLENES; SHAPE; CALIBRATION; WATER; X RADIATION

6203 (INIS-mf–11562, pp. 56) **State of art of assessing occupational nature of malignant lung neoplasm.** Placek, V. (Zavodni Ustav Narodniho Zdravi Uranoveho Prumyslu, Pribram (Czechoslovakia)); Sevc, J.; Klener, V.; Tomasek, L. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. CARCINOMAS/occupational diseases; MINERS/carcinomas; BIOLOGICAL RADIATION EFFECTS; CARCINOMAS; INHALATION; LUNGS; MEDICAL SURVEILLANCE; MINERS; PROBABILITY; RADON 222

6204 (INIS-mf–11562, pp. 58) **Application of personnel neutron dosimetry by UVVVR in neutron fields of nuclear power plants. I. Methodology of interpretation of UVVVR track dosemeter response.** Prouza, Z. (Karlova Univ., Prague (Czechoslovakia). Fakulta Vseobecneho Lekarstvi); Hermanska, J.; Prusa, J.; Studena, J.; Trousil, J.; Vacek, R. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. NUCLEAR POWER PLANTS/personnel dosimetry; PERSONNEL DOSIMETRY/neutron dosimetry; DOSE EQUIVALENTS; FISSION FOIL DETECTORS

6205 (INIS-mf–11562, pp. 71) **Current state and prospects of evaluating dose equivalents by UVVVR National Personnel Dosimetry Service.** Starostova, V. (Ustav pro Vyzkum, Vyrobu a Vyuziti Radioisotopu, Prague (Czechoslovakia)); Trousil, J.; Kleinova, H.; Prouza, Z. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. PERSONNEL DOSIMETRY/dose equivalents; ORGANIZING

6206 (INIS-mf–11562, pp. 72) **Models of absolute and of relative malignant lung neoplasm hazard in Czechoslovak epidemiological studies.** Sevc, J. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni); Kunz, E.; Tomasek, L. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. CARCINOMAS/risk assessment; MINERS/radiation hazards; CARCINOMAS; DELAYED RADIATION EFFECTS; EPIDEMIOLOGY; LUNGS; MINERS

6207 (INIS-mf–11562, pp. 73) **Results of epidemiological study of malignant lung neoplasm after 35 years of follow-up.** Sevc, J. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni); Kunz, E.; Kurzova, M.; Tomasek, L.; Placek, V.; Horacek, J. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. CARCINOMAS/miners; MINERS/delayed radiation effects; AGE DEPENDENCE; CARCINOMAS; MINERS; EPIDEMIOLOGY; LUNGS; RADIATION HAZARDS; TIME DEPENDENCE

6208 (INIS-mf–11562, pp. 82) **Model of proportional risk of malignant lung neoplasm.** Tomasek, L. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia)); Sevc, J. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118–: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days*. Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. CARCINOMAS/radiation hazards; RADIATION HAZARDS/mathematical models; CARCINOMAS; EPIDEMIOLOGY; LUNGS; MINERS

6209 (INIS-mf–11562, pp. 91) **Assessment of radiation load of personnel of Regional Institute of National Health in Ostrava.** Zenata, I. (Krajska Hygienicka Stanice, Ostrava (Czechoslovakia)); Lusnak, J.; Hillova, J. Ceska Lekarska Spolecnost J.E. Purkyne,

Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Czech). (CONF-8812118--: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. RADIOLOGICAL PERSONNEL/ radiation hazards; RADIATION DOSES; RADIATION PROTECTION; RADIUM 226; SEALED SOURCES

6210 (INIS-mf--11562, pp. 86) **Dosimetry in therapeutical uses of ^{252}Cf.** Vicanova, M. (Vyskumny Ustav Preventivneho Lekarstva, Bratislava (Czechoslovakia)); Nikodemova, D. Ceska Lekarska Spolecnost J.E. Purkyne, Prague (Czechoslovakia). Spolecnost Nuklearni Mediciny a Radiacni Hygieny; Institut Hygieny a Epidemiologie, Prague (Czechoslovakia). Ustav Hygieny Zareni; Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Dozimetrie Zareni; Vojenska Lekarska Akademie, Hradec Kralove (Czechoslovakia). Dec 1988. (In Slovak). (CONF-8812118--: 14. radiation hygiene days, Brno (Czechoslovakia), 8-9 Dec 1988). In *Abstracts of 14th radiation hygiene days.* Order Number DE90608347. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Published in summary form only. CALIFORNIUM 252/neutron dosimetry; NEUTRON THERAPY/neutron dosimetry; DIELECTRIC TRACK DETECTORS; GAMMA DOSIMETRY; NEUTRON DETECTORS; PHANTOMS; RADIATION DOSES; TISSUE-EQUIVALENT MATERIALS

6211 (INP--1314/D) **Initiation in present-day standards for radiation protection.** Niewiadomski, T. Institute of Nuclear Physics, Cracow (Poland). Apr 1986. 43p. (In Polish). Order Number DE90610866. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The principles of present-day radiological protection, basic concepts and units, dose limitation system and primary limits are briefly presented. 11 refs., 7 figs., 3 tabs. (author).

6212 (INP--1332/B) **Mixed field dosimetry at U-120 cyclotron neutron therapy beam: a comparison of two dosimetry systems.** Kneschaurek, P. (Technische Univ. Muenchen (Germany, F.R.)); Pszona, S.; Lazarska, B. Institute of Nuclear Physics, Cracow (Poland). 1986. 18p. Order Number DE90610873. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

At the place where neutron therapy is carried out with the use of the U-120 cyclotron the comparison of two dosimetric systems was made for fast neutron beam of mean energy 5.5 MeV. The D_n component as well as the D_γ one were measured with dosimeters used at the Institute of Nuclear Physics in Cracow and with the dosimetric set used at the Radiotherapy Institute of Technical University of Muenich. At the same time both dosimetric systems were compared by means of the ^{60}Co source at the Institute of Oncology in Cracow. The measurements have shown a good compatibility of the two systems. (author).

6213 (NEI-NO--94) **Radioactivity in foodstuffs 1987.** SNT-rapport. no. 1/88. Statens Naeringsmiddeltilsyn, Oslo (Norway). 1988. 35p. (In Norwegian). Order Number DE90609948. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

SNT-rapport.; no. 1/88.

The dose of radioactivity to which the average Norwegian consumer was exposed through the consumption of food during the year immediately following the Chernobyl accident was 0.15 mSv. Certain individuals with special dietary habits (large proportions of freswater fish and reindeer meat), and who live in regions particularly affected by radionuclide contamination, have been exposed to higher doses (0.4 to 1.8 mSv). These doses would have been considerably higher had not dietary advise been followed. Even though health risk assessments suggested in the spring of 1987 that it was reasonable to revoke the action levels then in force, they were nevertheless maintained after political consideration of the situation. Measures implemented in 1987 have resulted in a certain reduction of the dose to which the population has been exposed, and the associated costs have also fallen considerably in relation to the situation in 1986. The present report summarizes analytical results of monitoring and surveillance activities in 1987 and describes the measures introduced with regard to the various categories of food. Measures have been introduced primarily in connection with sheep meat production and reindeer farming, even if certain measures have been necessary also with regard to goat milk and cheese manufacture.

6214 (NEI-NO--95) **Radiation dose from food to man after Chernobyl.** SNT-rapport. no. 2/88. Statens Naeringsmiddeltilsyn, Oslo (Norway). 1988. 42p. (In Norwegian). Order Number DE90609949. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

SNT-rapport.; no. 2/88.

The geographical distribution in Norway of radioactive fallout from the Chernobyl accident varied considerably. In order to estimate radioactivity dose levels, two main categories of people were selected for study. The first category covered people who were assumed to have been exposed to much higher doses of radioactivity than the average, i.e. people consuming large amounts of food containing high levels of radioactivity. The other category covered people who were assumed to have received doses of radioactivity close to average. Two procedures were utilized for exposure measurements: Body levels of radioactivity were measured directly, and dietary studies were carried out to estimate the total intake of radioactivity through food as well as the proportion of the total intake which derived from the various foodstuffs. Furthermore, dietary changes and other precautions taken in consequence of the Chernobyl fallout were registered, and assessments were made of the degree to which radioactive cesium intake had been reduced as a result of these changes. The average effective dose equivalent due to the consumption of contaminated food during the first year after the Chernobyl accident was estimated to be in the range 0.12 to 0.25 mSv. A quarter of this dose was due to the consumption of milk. Apart from the Sami reindeer herdsmen in central and southern Norway, the dose which the especially exposed groups had received during the first year was estimated to 0.5 to 1.0 mSv. Almost 90% of the dose derived from the consumption of "wild" freshwater fish, reindeer meat and milk. Most of the Sami people received doses varying from 1 to 3 mSv in the first year. By far the greatest contribution (90%) arised from the consumption of reindeer meat.

6215 (NILU-OR--68/88) **Measurement of radioactivity in Norway: Annual report 1987.** Berg, T.C. Norsk Inst. for Luftforskning, Lillestroem (Norway). May 1988. 22p. (In Norwegian). Order Number DE90610874. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A nation-wide network of seven monitoring stations for continuous registration of radioactivity in the air has been established in Norway. Via the telecommunication network, collected data are dayly automatically transmitted to the Norwegian Institute for Air Research (NILU). High radiation levels will trigger an alarm for immediate transmission. The monitoring system and field experiences in connection with its operation are described. NILU's directions in the event of radiation alarm are specified and radiation measurements for 1987 are presented.

6216 (SSI--89-03) **Activity report 1 jan 1987 - 30 jun 1988. Swedish National Institute of Radiation Protection Research department (Main division of Research and Development).** National Inst. of Radiation Protection, Stockholm (Sweden). 13 Feb 1989. 34p. (In Swedish). Order Number DE90610875. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Present activities and results obtained during the period are described under the following headings: * Research and development projects. - Radioactivity in the environment. - Dosimetry. - Medical and biological effects of radiation. * Environment control measurements and reference measurements. - Environment control measurements and discharge control measurements. - Reference measurement and calibration activities. * Other activities. - Research secretariat. - Computer group. - Other. * Published work etc. - Published work. - Conference contributions. - SSI-reports. * Personnel.

6217 (SSI--89-08) **Ambulating radiography.** Magnusson, K. National Inst. of Radiation Protection, Stockholm (Sweden). 25 Apr

1989. 19p. (In Swedish). Order Number DE90610876. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Strong gamme or X-ray sources are utilized for non-destructive testing of i.e. bridges. The activities involve certain risks of accident that might lead to serious injuries caused by radiation. The National Institute of Radiation Protection has during the laste decade greatly yhe inspection rate in this area. It has today made controls of most enterprieses running ambulating radiography. (O.S.).

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Refer also to citation(s) 4587, 5461, 5476, 5512, 5525

6218 (AD-A-211550/9/XAB) **Quantitative interpretation of Auger line shapes and electron/photon stimulated desorption. Final report, 1 July 1980-31 March 1989.** Ramaker, D.E. George Washington Univ., Washington, DC (USA). Dept. of Chemistry. 18 Aug 1989. 16p. Available from NTIS, PC A03/MF A01.

This project has involved a quantitative theoretical interpretation of electron spectroscopic data with a view toward elucidating the chemical environment and electronic structure of atoms in the bulk and adsorbed on solid surfaces. Many-body effects, such as shake satellites, initial core-hole screening, and final state hole-hole correlation, etc., were examined and found to have significant effects on the spectral line shapes. More recently, the author examined electron spectroscopic data for the high-temperature superconductors, and for chemisorbed species on metals. Electron/photon stimulated desorption (ESD/PSD) was also of interest. Here, an interpretation of spectroscopic data and comparison with PSD spectral yields was very helpful in obtaining an understanding of the image charge, surface resonances, polarization, and the role of many-body interactions in the desorption mechanism itself.

6219 (CNEA-NT–3/89) **Point defects dynamics in a stress field: Application to hexagonal close packed metals.** Smetniansky de De Grande, Nelida. Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Dept. de Materiales; La Plata Univ. Nacional (Argentina). Dept. de Fisica. 1989. 106p. (In Spanish). (CNEA-PMTM/T–7). Order Number DE90610563. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The dependence of anisotropic defect diffusion on stress is studied for a hexagonal close packed (hcp) material under irradiation and uniaxially stressed. The diffusion is described as a discrete process of thermally activated jumps. It is shown that the presence of an external stress field enhances the intrinsic anisotropic diffusion, being this variation determined by the defect dipole tensors' symmetry in the equilibrium and saddle point configurations. Also, the point defect diffusion equations to sinks, like edge dislocations and spherical cavities, are solved and the sink strengths are calculated. The conclusion is that the dynamics of the interaction between defects and sinks is controlled by the changes in diffusivity induced by stress fields. (Author).

6220 (CONF-891119–23) **Ion-beam mixing and tribology of Fe/B multilayers.** Hu, Ren Yuan; Rehn, L.E.; Fenske, G.R.; Baldo, P.M. Argonne National Lab., IL (USA). Nov 1989. 7p. Sponsored by U.S. DOE Conservation & Renewable Energy; U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Materials Research Society fall meeting; Boston, MA (USA); 27 Nov - 2 dec 1989. Order Number DE90003560. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Interdiffusion of Fe and B trilayer specimens during 1-MeV Kr^+ bombardment was studied using Rutherford backscattering and electron microscopy. The square of the interdiffusion distance during mixing at 300°C was found to depend linearly on the irradiation dose. Arrhenius behavior with an apparent activation enthalpy of 0.7 eV was observed for the mixing between 200 and 500°C. Electron microscopy of ion-beam mixed multilayer specimens revealed that two crystalline compounds, Fe_2B and Fe_3B, formed during bombardment at 450°C, while two different amorphous Fe/B phases formed at 300°C. Substantially improved adhesion and reduced friction were observed for Fe/B multilayers ion-beam mixed onto M50 steel substrates at 300 and 450°C. 14 refs., 5 figs.

6221 (CONF-891119–25) **Phonon anomaly at T_c in (Y/Er)$Ba_2Cu_3O_{7-\delta}$.** Sharma, R.P.; Rehn, L.E.; Baldo, P.M.; Liu, J.Z. Argonne National Lab., IL (USA). Nov 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Materials Research Society fall meeting; Boston, MA (USA); 27 Nov - 2 dec 1989. Order Number DE90003562. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Ion channeling in single crystals of (Y/Er)$Ba_2Cu_3O_{7-\delta}$ reveal an abrupt change (~0.01A) at the superconducting transition temperature (T_c) in displacements of the Cu and O atoms perpendicular to the [001] direction. This anomalous change in atomic displacements shifts directly with stoichiometry-induced changes in T_c. Blocking patterns indicate no large structural changes across T_c. 12 refs., 3 figs.

6222 (CONF-8810246–6) **Laser-induced surface ablation and optical damage of ZnS crystals caused by single- and multiple-pulse laser-irradiation.** Arlinghaus, H.F. (Argonne National Lab., IL (USA)); Calaway, W.F.; Gruen, D.M.; Chase, L.L. Argonne National Lab., IL (USA). [1989]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38;W-7405-ENG-48. From 20. annual symposium on optical materials for high-power lasers; Boulder, CO (USA); 26-28 Oct 1988. Order Number DE90003807. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Velocity distributions and yields of neutral Zn atoms emitted from laser-irradiated ZnS crystals at power densities far below the single-pulse damage threshold have been analyzed by high-resolution two-photon laser-induced fluorescence spectroscopy and also by electron impact ionization mass spectrometry. Large differences in the measured kinetic temperatures have been found between the single- and multiple-pulse laser irradiation experiments. The high-kinetic temperatures, obtained in multiple-pulse experiments, may be caused by cumulative surface modification, such as thermally-induced cracking, leading to a reduction of the thermal conductivity compared to the bulk value. Optical damage was related to the interaction of a plasma formed at a critical combination of particle density and laser intensity, with the surface. 19 refs., 9 figs.

6223 (DOE/ER/45239–T1) **[Surface studies at the NSLS]: Progress summary.** State Univ. of New York, Albany, NY (USA). Research Foundation. Nov 1989. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-86ER45239. Order Number DE90003173. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The most significant results obtained in the past six months are the growth and the identification of a new, body-centered-tetragonal, phase of copper. The new phase was grown epitaxially on a [001] surface of palladium, and seems to confirm a prediction recently made by theorists at the University of Pennsylvania. We have completed a LEED intensity analysis of the c(2 × 2) phase formed by Mn on Pd at low coverages, and have established that this phase is probably a Pd_3Mn alloy with a Cu_3Au structure. A study of the c(2 × 2) phase obtained by deposition of Mn on a Cu[001] surface has so far produced no solution, despite intense calculational efforts and photoemission experiments. The evaluation of our photoemission experiments on Ag[001] and Ag[111] surfaces has been completed successfully.

6224 (IC–89/175) **A simple model for the determination of L_0, D and tau in a semiconductor and their temperature dependence.** Ahmed, F. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 5p. Order Number DE90610564. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

It is very important to characterize the quality of a semiconductor material before it is processed into a device. Diffusion length L_0, diffusion constant D and carrier lifetime tau of minority carriers are some of the parameters which play a vital role in determining the quality of a semiconductor material. Recently Ahmed and coworkers have shown that by measuring the frequency response of a time varying ($e^{i\omega t}$) light (or electron) beam one can determine all the important parameters including the absorption coefficient of light and surface recombination velocity. Here we propose a simple method by which one can obtain L_0, D and tau separately from measured phase shift of short circuit photo current at some modulation frequency ω and at two different wavelengths of incident light. It

is suggested that the above procedure is particularly suitable for inferring the temperature dependence of these parameters. (author). 5 refs.

6225 (IC–89/227) **Non-adiabatic effects in the electron and phonon spectra of a Peierls insulator.** Dzyub, I.P. (AN Ukrainskoj SSR, Kiev (Ukrainian SSR). Inst. Teoreticheskoj Fiziki); Zerov, Yu.E. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 14p. Order Number DE90610551. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The phonon and electron spectra of the discrete version of the Su, Schrieffer and Heeger model are calculated taking into account the polarization effects. It is shown that there exists a finite probability of electron states relaxation even at zero temperature. (author). 5 refs, 1 fig.

6226 (IC–89/240) **Dislocation annihilation mechanism for the formation of dislocation free zone at a crack tip.** Lung, C.W. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 14p. Order Number DE90610552. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This paper proposes a dislocation annihilation model for the formation of dislocation free zone at a crack tip which may be appropriate to explain more results on DFZ investigations. (author). 17 refs, 5 figs.

6227 (IC–89/241) **Exchange and correlation effects in the Visscher-Falicov model for metal intercalated graphite.** Miesenboeck, H.M.; Tosi, M.P. International Centre for Theoretical Physics, Trieste (Italy). Sep 1989. 27p. Order Number DE90610553. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A simple model for metal intercalated graphite as a layered electron gas treated in the random phase approximation, which was proposed in early work of Visscher and Falicov, is extended to include exchange and short-range intraplane correlations between the electrons. Main attention is focussed on the static screening function of the model system, in relation to effective pair potentials in metal intercalants. The local field factor accounting for exchange and correlation is related to the intraplane electron structure factor and the latter is evaluated in a simple pseudoclassical approach, which is tested against known results for a quantal 2D electron gas. Screening of an external point charge is shown to be appreciably modified by exchange and correlation in the case when it lies in an electron plane, leading to a deeper main attractive well between two external charges lying in the same electron plane. On the other hand, exchange and correlation have only minor effects when the charges lie at mid distance between two electron planes, at least if reasonable physical requirements are made on acceptable values for the electron screening length in the relevant range of model parameters. (author). 34 refs, 1 tab., 5 figs.

6228 (INIS-BR–1752, pp. 24-49) **Synthesis characterization and applications of lead and barium-titanate materials prepared by the sol-gel method.** Aegerter, M.A. (Sao Paulo Univ., Sao Carlos, SP (Brazil). Inst. de Fisica e Quimica); Charbowillot, Y.; Mohallem, N.; Silva, A.A. da; Godoy, L.H. Secretaria Estadual de Ciencia e Tecnologia, Rio de Janeiro, RJ (Brazil). 1989. (CONF-8908187–: 2. state meeting of new materials and 1. Florida-Brazil seminar on materials, Rio de Janeiro (Brazil), 2-4 Aug 1989). In *Advanced Ceramics.* Order Number DE90608004. Available from NTIS (US Sales Only), PC A16/MF A01 - OSTI; INIS.

Sol-gel processing represent a promising method for the fabrication of dielectric materials. In this study we review the preparation and characterization of lead and barium titanate derived materials in form of gels, powders and films the relative merits and problems of the different processing techniques are investigated. The physical properties of these materials obtained either in the amorphous or crystalline form and possible applications of technological interest are finally presented. X-ray diffraction is used to analyze the compounds. (author).

6229 (INIS-BR–1752, pp. 321-331) **Microstructure and mechanical properties of silicon nitride structural ceramics of silicon nitride.** Strohaecker, T.R. (Rio Grande do Sul Univ., Porto Alegre (Brazil)); Nobrega, M.C.S.; Hubner, H. Secretaria Estadual de Ciencia e Tecnologia, Rio de Janeiro, RJ (Brazil). 1989. (In Portuguese). (CONF-8908187–: 2. state meeting of new materials and 1. Florida-Brazil seminar on materials, Rio de Janeiro (Brazil), 2-4 Aug 1989). In *Advanced Ceramics.* Order Number DE90608004. Available from NTIS (US Sales Only), PC A16/MF A01 - OSTI; INIS.

The utilization of direct evaluation technic of tenacity for fracturing by hardness impact in silicon nitride ceramics is described. The microstructure were analysied, by Scanning Electron Microscopy, equiped with a microanalysis acessory by X ray energy dispersion. The difference between the values of K_{IC} measure for two silicon nitride ceramics is discussed, in function of the microstructures and the fracture surfaces of the samples studied. (C.G.C.).

6230 (INP–1309/PS) **Rutherford backscattering, Coulomb excitation, and X-rays production studied in channeling conditions.** Kopta, S.; Hajduk, R.; Hrynkiewicz, A.Z.; Maydell-Ondrusz, E.; Lazarski, S.; Rajchel, B. Institute of Nuclear Physics, Cracow (Poland). 1986. 44p. Order Number DE90610600. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Results of experimental investigation of proton channeling in tungsten monocrystal by detection of backscattered protons and by detection of γ-rays and X-rays are presented. Analysis of energy spectra of backscattered protons and of γ-ray yields allowed us to determine the random and channeled stopping power. The averaged ratio β_0 of channeled to random stopping power in <111> channel was determined to be 0.447+-0.005, whereas the β_0 value for well-channeled protons is ~0.37. 14 refs., 16 figs. (author).

6231 (JINR-R–17-88-478) **Properties of the cross section of small-angle scattering on anisotropic bodies.** Svetogorski, D.A. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1988. 7p. (In Russian). Order Number DE90610565. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

It is shown that the cross section of small-angle neutron scattering (SANS) on an anisotropic system of point scatterers is determined by the tensor of second moments of the correlation function of the system. The mean square radius of gyration of the system is the trace of the tensor of second moments. A simple method is proposed for experimental determination of the tensor of second moments by small-angle measurements with rotation of a sample. 14 refs.; 1 fig.

6232 (LA-UR–89-4009) **Effect of carbon on ion beam mixing of Fe-Ti bilayers.** Hirvonen, J.P. (Los Alamos National Lab., NM (USA)); Nastasi, M.; Lappalainen, R.; Sickafus, K. Los Alamos National Lab., NM (USA). [1989]. 7p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. DEW-88-24. (CONF-891119–13: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989). Order Number DE90003650. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The influence of implanted carbon on ion beam mixing of a Fe-Ti system was investigated. Carbon was introduced into bilayer samples by implanting ^{13}C isotopes. The implantation energies were selected to set the mean range of carbon ions in either the iron or titanium layer. The effect of implanted carbon on 400 keV Ar ion mixing in the temperature range from 0 to 300°C was studied using Rutherford backscattering spectroscopy at the energy of 5 MeV. Changes in carbon concentration profiles were probed utilizing the resonance of the nuclear reaction $^{13}C(p,\gamma)^{14}N$ at the proton energy of 1.748 MeV. The measurements revealed that mixing was not affected by carbon implanted into the titanium layer. However, carbon in the iron layer remarkably retarded mixing at all temperatures investigated. Significant changes in carbon depth distributions were observed only when the sample with implanted carbon in the iron layer was mixed at 300°C. These results are explained in terms of the enhanced mobility of carbon in an evaporated iron film which allows segregation to the interface. At low temperatures, however, vacancy-carbon interaction in iron may have a contribution to the retarded ion beam mixing. 19 refs., 3 figs.

6233 (ND-R–910(S)) **FIREFLY 6 (FIRECOMET) (HELLFIRE 8B). A revised and extended computer program for calculating the intensities of reflections on X-ray or neutron powder diffraction records.** Ferguson, I.F. (UKAEA Northern Research Labs., Springfields (UK)); Hardy, A.D.; Rogerson, A.H.; Modi, M.V.;

Duckworth, M.R. UKAEA Northern Research Labs., Risley (UK). Nov 1988. 19p. Available from H.M. Stationery Office, London, price Pound 8.00.

FIREFLY 6 is an extension of FIREFLY 3, based on 13 years' operational experience. The program now includes the ability to calculate all possible Miller indices for a given crystallographic unit cell, without requiring them to be input separately. Consequently, given a material with a defined crystallographic unit cell, the program can compute the positions and intensities of all possible Bragg reflections which should occur on a powder pattern obtained from the material using various types of X-ray or neutron diffraction equipment. The program is written in FORTRAN 4 for use on an ICL 2982 computer. (author).

6234 (UzIYaF-R-9-263) **Defect formation in media with short-range order strong fluctuations.** Turaev, N.Yu.; Usanova, G.A. AN Uzbekskoj SSR, Tashkent (USSR). Inst. Yadernoj Fiziki. 1987. 8p. (In Russian). Order Number DE90609015. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

A theory of elastic defect production in strong fluctuative media, that from the new point of radiation-physical processes is characterized by absence of rigid tranlational periodicity and presence of many metastable structural configurations, is developed. It is shown that defect production in strong fluctuative media has a series of peculiarities; existence of shift barrier spectrum and negative correlation of displaced atom potential energy.

6235 **Mechanisms and kinetics of ion beam-induced compositional modifications.** Lam, N.Q. (Argonne National Lab., Argonne, IL (US)). pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). DOE Contract W-31-109-ENG-38. (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

Near-surface compositional modification of ion-bombarded alloys results from the dynamic interplay of several atomistic processes. In addition to displacement mixing leading to a randomization of atomic locations, which is dominant at relatively low temperatures, and preferential loss of alloying elements by sputtering, many thermally-activated processes, including radiation-enhanced segregation and Gibbsian adsorption, also play important roles. The relative contributions of these processes to the evolution of the target composition profile depends on the target materials and irradiation variables. Although a good understanding of the individual processes has been achieved, information regarding their synergistic effects on alloy surface modification is still limited. In this article, these processes are characterized in simply physical terms, and the present understanding of their relative significance and contributions in changing the target composition during ion bombardment is discussed in view of recent progress in theoretical modeling and experimental study.

6236 **Optical emission diagnostics of electron cyclotron resonance and glow discharge plasmas for a-Si:H and a-SiC:H film depositions.** Yang, C.L. (Jet Propulsion Lab., Pasadena, CA (USA)); Shing, Y.H.; Allevato, C.E. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). (CONF-880965–: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

In situ plasma diagnostics for electron cyclotron resonance (ECR) and RF glow discharge deposition have been investigated using the optical emission spectroscopy (OES) technique. The ECR and RF glow discharge plasmas used for a-Si:H and a-SiC:H film depositions are studied by monitoring the emission of SiH^*, H^*, H^*_2 and CH^*, excited states. The OES of the ECR plasma shows a strong emission at 434 nm from H^*, which is not detectable in the glow discharge plasma. Steady-state OES studies have established preliminary correlations between SiH^* and CH^* emission intensities and the film deposition rate. Transient OES spectra of SiH_4 and CH_4 plasmas have shown different kinetics in SiH^* and CH^* emission intensities. Transient studies of the SiH^* emission intensity have indicated that additional mechanism for producing the SiH^* species become evident in hydrogen diluted silane plasmas.

6237 **Safe hole trapping, light soaking and secondary photocurrent transients in amorphous silicon.** McMahon, T.J. (Solar Energy Research Inst., Golden, CO (USA)); Crandall, R.S. pp. 1671 of Twentieth IEEE photovoltaic specialists conference, 1988. IEEE Service Center, Piscataway, NJ (1988). DOE Contract AC02-83CH10093. (CONF-880965–: 20. IEEE photovoltaic specialists conference, Las Vegas, NV (USA), 26-30 Sep 1988).

A new analysis is developed for long secondary photocurrent transients which gives the distribution of trapped holes in valence band tail states. Thermally assisted tunneling to dangling bonds is implicated as the rate limiting step in hole-recombination. Light-soaking causes the energetically deeper hole traps with the longer residence times to be lost first and in the same number as would be expected for the increase in dangling bonds; This result supports a model which has hole trapping in valence tail states as a precursor to light induced dangling bonds.

6238 **Channeling investigation of the lattice location of Ti in Ti-implanted optical waveguides in $LiNbO_3$.** Buchal, C. (IFF/KFA, D-5170 (DE)); Mantl, S.; Thomas, D.K. pp. 763 of Fundamentals of beam-solid interactions and transient thermal processing. Aziz, M.J.; Rehn, L.E.; Stritzker, B. Materials Research Society, Pittsburgh, PA (1988). (CONF-8711126–: Symposium on fundamentals of beam-solid interactions and transient thermal processing, Boston, MA (USA), 30 Nov - 3 dec 1987).

This paper describes ion channeling of 3 MeV He ions employed to investigate the lattice location of Ti in Ti implanted optical waveguides in $LiNbO_3$ after solid Phase Epitaxy. Particle-Induced X-rays (PIXE) from Ti at 4.5 keV (K_α) and Nb at 2.2 keV ($L_{\alpha\beta}$) and 16.6 (K_α) have been detected and analyzed simultaneously. All scans yield similar behaviour of the Ti and the Nb signals. This provides clear evidence that within well annealed implanted waveguides the Ti^{4+} and the Nb^{5+} ions occupy equivalent lattice positions.

6561 Superconductivity

Refer also to citation(s) 5474, 5478, 5480, 5481, 5486, 5490, 5506, 5507, 5523

6239 (BNL–43107) **Magnetic and electronic correlations in $YBa_2Cu_3O_{6+x}$.** Tranquada, J.M. Brookhaven National Lab., Upton, NY (USA). [1989]. 20p. Sponsored by U.S. DOE Energy Research; U.S.-Japan Cooperative Neutron Scattering Program. DOE Contract AC02-76CH00016. (CONF-8907139–3: International School of Materials Science and Technology: earlier and recent aspects of superconductivity, Erice (Italy), 4-16 Jul 1989). Order Number DE89017604. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

$YBa_2Cu_3O_{6+x}$ is an antiferromagnetic insulator in its tetragonal phase at small x, and it becomes a superconducting metal in the large x orthorhombic phase. The transition between the two phases is controlled by the orientational ordering of CuO_x chain segments and dielectric screening by the BaO layers. In the orthorhombic phase, holes from the chains are transferred to the CuO_2 planes, and the superconducting transition temperature scales with the density of O 2p holes. The antiferromagnetic ordering in the tetragonal phase is dominated by localized Cu moments in the CuO_2 planes. The two-dimensional (2D) coupling between those spins is unusually strong. The interaction between nearest-neighbor planes is sufficiently strong that spins in bilayers remain highly correlated well above the Neel temperature. Long-range order is destroyed when a significant density of O 2p holes is present in the planes; however, there is evidence that Cu moments survive and interact in the metallic phase. 55 refs., 13 figs.

6240 (BNL–43407) **Magnetic mechanisms of high temperature superconductivity.** Emery, V.J. Brookhaven National Lab., Upton, NY (USA). [1989]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH00016. (CONF-891117–11: 34. conference on magnetism and magnetic materials, Boston, MA (USA), 28 Nov - 1 dec 1989). Order Number DE90003625. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A survey of the relationship between magnetism and superconductivity in high temperature superconductors will be presented. It will be shown that strong electron correlations are responsible for magnetic behavior and for the specific electronic structure of the charge carriers. A survey of various proposals for a magnetic origin

of high temperature superconductivity will be given, including the possibilities of unconventional pairing, new mechanisms and new forms of many-body theory. An important issue is whether superconductivity is an intrinsic property of mobile holes in an antiferromagnet. This possibility will be compared and contrasted with more conventional approaches to the problem. 32 refs.

6241 (DOE/OR/21400–T407) **The kind of mathematics involved in applied superconductivity research.** Dresner, L. Oak Ridge National Lab., TN (USA). 19 Oct 1989. 7p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. Order Number DE90003706. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

This paper discusses the mathematic process used in studying the property of superconductivity. 6 refs. (LSP)

6242 (IC–89/270) **What influences order parameters across the superconducting phase boundary?.** Das, M.P. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 8p. Order Number DE90610663. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

In this paper we discuss phase diagram of high temperature oxide superconductors in the light of most recent experimental data. We raise several issues on the nature of superconducting order parameters along the superconducting phase boundary in terms of normal state properties with a view to examining the mechanism of superconductivity in oxides. (author). 21 refs, 1 fig.

6243 (IC–89/271) **Pressure induced superconductivity in elemental solids.** Asokamani, R. (International Centre for Theoretical Physics, Trieste (Italy)); Subramoniam, G.; Sankaralingam, S.; Pauline, S.; Umamaheswari, R. International Centre for Theoretical Physics, Trieste (Italy). Sep 1989. 16p. Order Number DE90610664. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This paper aims at explaining the phenomenon of pressure induced superconductivity that has been experimentally observed in some of the elemental solids such as black Phosphorus, Tellurium and Iodine. As Xenon has been shown to become metallic recently at very high pressure, we predict possible superconductivity in Xe. Our calculations are based on the self-consistent electronic band structure calculations performed on the basis of the LMTO method. The band structure outputs are used to calculate the electron phonon coupling constant and the superconducting transition temperature. (author). 36 refs, 5 figs, 3 tabs.

6244 (JINR-R–14-88-477) **Microwave radiation absorption by Ho(Y)-Ba-Cu-O superconducting ceramics.** Vavryshchuk, Ya.; Aliev, M.K.; Volosyanyj, S.P.; Muminov, T.M.; Olimov, B.A.; Kholbev, I. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems. 1988. 4p. (In Russian). Order Number DE90610665. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The derivative $\delta R/\delta H=f(HT)$ of microwave power absorption for superconducting ceramics as a function of temperature and magnetic field was investigated. A new narrow peak is discovered at $T-T_c$. It is shown that maxima f(H,T) divide the phase space (H,T) into three regions having the features of the Meissner, mixed and normal phases, respectively. It is pointed to a possibility of interpreting these states as similar states of Josephson's transitions. 5 refs.; 3 figs.

6570 Theoretical and Mathematical Physics

Refer also to citation(s) 6037, 6061, 6095, 6461

6245 (ENEA-RT-TIB–88-51) **A spinor approach to the propagation in self-focusing fibers.** Dattoli, G.; Di Lazzaro, P.; Torre, A. ENEA, Frascati (Italy). Centro Ricerche Energia. May 1989. 23p. Order Number DE90724604. Available from NTIS (US Sales Only), PC A03/MF A01.

Submitted to Journal of Mathematical Physics.

The most widespread used groups to treat current problems both in quantum and classical mechanics are SU(2), SU(3) and SU(1,1). The use of their spinorial representations also provides the natural link between the group theoretic analysis and the geometrical representation of the problem under study. An important by product of the above analyses has been the discovery of an unsuspected equivalence between the so called Cayley-Klein (CK) parameters describing rotation in classical mechanics and the Wei-Norman (WN) functions used in quantum mechanics to explicitly construct the evolution operator. In this paper, we exploit a spinor representation of wave propagation in self-focusing fibers and identify the relevant CK parameters. The use of the non-Hermitian matrix realization of the SU(1,1) group is instrumental to this analysis, also providing an immediate and straightforward understanding of the fiber evolution operator in terms of optical elements. The Helmholtz equation for the propagation of an electromagnetic wave in a self-focusing fiber is reduced, to a Pauli-type two component equation in the paraxial approximation. The fiber-spinor components are then shown to be related to the ray height and reduced slope. Finally, comments on the meaning of the paraxial approximation are presented.

6246 (IC–89/100) **Physical versions of non-linear gravity theories and positivity of energy.** Sokolowski, L.M. International Centre for Theoretical Physics, Trieste (Italy). May 1989. 14p. Order Number DE90610473. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In a recent letter Brans has criticised claims that non-linear metric theories of gravity are physically equivalent to general relativity with additional fields. We agree with his opinion that the physical metric is determined by its interaction with matter but emphasize that at present the available data are too scarce for it. We argue that for the theories which are mathematically equivalent under a conformal rescaling of the metric (this is the case of Lagrangian solely depending on the scalar curvature) a unique choice of physical variables can be based on a theoretical criterion - that of positivity of energy. (author). 21 refs.

6247 (IC–89/104) **A lattice gas model for enzyme kinetics (A correlated walks theory and variational procedures).** Mejdani, R. International Centre for Theoretical Physics, Trieste (Italy). May 1989. 17p. Order Number DE90610418. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

We have shown that by using a correlated walks theory or variational procedures, for the lattice gas model we can find for enzyme kinetics some new equations, which in the limit of no interactions between sites reduce to the classical Michaelis-Henri equation. These new equations can be useful for the experimental investigation. (author). 8 refs, 6 figs.

6248 (IC–89/151) **Radiation of electromagnetic waves by an accelerated charged particle in medium.** Risbud, A.A.; Tsintsadze, N.L. International Centre for Theoretical Physics, Trieste (Italy). Jun 1989. 10p. Order Number DE90610458. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

We have investigated the effect of acceleration of a charged particle on its Cerenkov emission and ionization losses. We have considered the accelerated motion of a charged particle in an infinite medium with acceleration along with the direction of its motion. The Maxwell equations, with appropriate current and charge densities, are solved to obtain electromagnetic fields. Hence the force arising from the interaction of the accelerated charged particle with the medium (dielectric or plasma) is calculated. Part I if more general and its results are applicable to any acceleration. Part II deals with small acceleration and small interaction time. It is found that the acceleration of charged particle strongly changes both its Cerenkov emission and ionization-losses. The results obtained are analysed and discussed in both parts. (author). 4 refs.

6249 (IC–89/180) **Representations of braid group obtained from quantum sl(3) enveloping algebra.** Ma Zhongqi. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 19p. Order Number DE90610459. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The quantum Clebsch-Gordan coefficients for the coproduct 6x6 of the quantum sl(3) enveloping algebra are computed. Based on the representation 6, the representation of the braid group and the corresponding link polynomial are obtained. The link polynomials based on the representations of the quantum sl(3) enveloping algebra with one row Young tableau are discussed. (author). 11 refs, 3 tabs.

6250 (IC–89/181) **Dependence of arithmetic functions and differential transcendence of Dirichlet series.** Laohakosol, V. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 24p. Order Number DE90610419. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Different kinds of dependence (linear and algebraic) are investigated in the domain of arithmetic functions under addition and convolution, while measures of differential transcendence are derived in the domain of Dirichlet series. (author). 18 refs.

6251 (IC–89/186) **The Einstein A-coefficient of spontaneous emission: A relativistic calculation in the Heisenberg representation.** Barut, A.O.; Salamin, Y.I. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 15p. Order Number DE90610460. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

We present a simple approach to the relativistic calculation of the rates of spontaneous emission starting from the Heisenberg picture formula for the power radiated by a charged particle undergoing acceleration, and evaluate atomic decay rates using relativistic Dirac-Coulomb wavefunctions. The spin of the electron, embedded in its relativistic wavefunction, is shown to correctly provide the two polarization states of the emitted radiation. We discuss selection rules and calculate the Hydrogen 2 P -> 1 S transition rate, among others, to be $\Gamma = (6.2650 +- 0.0007)x10^8 s^{-1}$ in good agreement with the full field theory calculation as well as with experiment. (author). 14 refs.

6252 (IC–89/188) **A new characterization of Bloch function in the unit ball of C^n.** Shi Jihuai. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 11p. Order Number DE90610420. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Bloch function in the unit disc v has many different but equivalent characterizations. Recently, a new characterization has been obtained by the study of Hankel operators. The purpose of this note is to generalize this characterization to the unit ball of C^n. 7 refs.

6253 (IC–89/189) **Random power series in the unit ball of C^n.** Shi Jihuai. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 14p. Order Number DE90610421. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The random power series in the unit disc has been studied by many authors. In this paper, we studied the random power series in the unit ball of C^n and generalized some results in the unit disc to the unit ball, in particular, the result obtained recently by Duren has been generalized to the unit ball. The main tool used here is the generalized Salem-Zygmund's theorem. (author). 12 refs.

6254 (IC–89/193) **Differential operators associated with Gegenbauer polynomials - 3. The regular case.** Onyango-Otieno, V.P. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 15p. Order Number DE90610422. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

We study the regular case of the Gegenbauer differential equation - $((1-x^2)^{\nu+1/2}y^1(x))^1+\nu^2(1-x^2)^{\nu-1/2}y(x) = \lambda(1-x^2)^{\nu-1/2}y(x)$, ($\chi$ is an element of $(-1,1)$,$-1/2 < \nu < 1/2$) in both the right-definite and left-definite cases by using a method based on a classical approach due to E.C. Titchmarsh. We then link the Titchmarsh approach with operator theoretical results in the spaces $L_w^2(-1,1)$ and $H_{p,q}^2(-1,1)$. (author). 13 refs.

6255 (IC–89/199) **Propagation of electromagnetic waves in multidimensional homogeneous cosmologies.** Sokolowski, L.M. (International Centre for Theoretical Physics, Trieste (Italy)); Litterio, M.; Occhionero, F. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 15p. Order Number DE90610474. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

It is shown that electromagnetic waves initially emitted towards the higher dimensions cannot emerge in the physical external space-time as ordinary photons. Two frequencies can be assigned to an ordinary photon: one associated with the physical 4-space and the other with the total space-time. It is a general property of known multidimensional cosmological solutions that the latter decreases in time (redshift) while the former increases (blueshift). (author). 25 refs.

6256 (IC–89/207) **Superconformal algebra on meromorphic vector fields with three poles on super-Riemann sphere.** Wang Shikun (Academia Sinica, Beijing, BJ (China). Inst. of Applied Mathematics); Xu Kaiwen. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 9p. Order Number DE90610423. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Based upon the Riemann-Roch theorem, we construct superconformal algebra of meromorphic vector fields with three poles and the relevant abelian differential of the third kind on super Riemann sphere. The algebra includes two Ramond sectors as subalgebra, and implies a picture of interaction of three superstrings. (author). 14 refs.

6257 (IC–89/210) **Supermoduli spaces.** Dolgikh, S.N. (Moskovskij Fiziko-Tekhnicheskij Inst., Moscow (USSR)); Rosly, A.A.; Schwarz, A.S. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 14p. Order Number DE90610424. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The connection between different supermoduli spaces is studied. It is shown that the coincidence of the moduli space of (1—1) dimensional complex manifolds and N=2 superconformal moduli space is connected with hidden N=2 superconformal symmetry in the superstring theory. (author). 14 refs.

6258 (IC–89/220) **A note on birth interval distributions.** Shrestha, G. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 7p. Order Number DE90610425. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

A considerable amount of work has been done regarding the birth interval analysis in mathematical demography. This paper is prepared with the intention of reviewing some probability models related to interlive birth intervals proposed by different researchers. (author). 14 refs.

6259 (IC–89/225) **Trapped surfaces in monopole-like Cauchy data of Einstein-Yang-Mills-Higgs equations.** Malec, E. (International Centre for Theoretical Physics, Trieste (Italy)); Koc, P. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 19p. Order Number DE90610475. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

We choose the nonabelian monopole solution of Bogomolny, Prasad and Sommerfield as a part of Cauchy data for the evolution of Einstein-Yang-Mills-Higgs equations. Momentarily static spherically symmetric data for gravitational fields are obtained numerically via the Lichnerowicz equation. In the case of generic scaling of fields we have found initial data with trapped surfaces. (author). 13 refs.

6260 (IC–89/248) **Uniqueness of closure of the constraint algebra for quantum gravity.** Christodoulakis, T. (International Centre for Theoretical Physics, Trieste (Italy)); Korfiatis, E. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 21p. Order Number DE90610476. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

We investigate the closure of the quantum algebra for the constraints of pure gravity considering a wide class of regularisation assumptions. We thus establish that the only regularisation assumption, within this class, that closes the algebra is the one introduced by one of the authors (T.C. with Jorge Zanelli) in earlier publications and that the closure is a result of both the regularisation and the introduction of a tensor distribution. (author). 15 refs.

6261 (IC–89/262) **Universal moduli space and string theory.** Schwarz, A.S. International Centre for Theoretical Physics, Trieste (Italy). Sep 1989. 7p. Order Number DE90610426. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

The construction of the universal supermoduli space is given. The super-Mumford form (the holomorphic square root from the string measure) is extended to the universal supermoduli space and expressed through the superanalog of Sato's tau-function. The hidden N=2 superconformal symmetry in the string theory is considered. (author). 13 refs.

6262 (IC–89/269) **A method for computing the stationary points of a function subject to linear equality constraints.** Uko, U.L. International Centre for Theoretical Physics, Trieste (Italy). Sep 1989. 6p. Order Number DE90610427. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

We give a new method for the numerical calculation of stationary points of a function when it is subject to equality constraints. An application to the solution of linear equations is given, together with a numerical example. (author). 5 refs.

6263 (IC–89/280) **On Einsteinization of background curved space in the induced quantum gravity.** Novozhilov, Y.V. (Leningrad Univ. (USSR). Dept. of Theoretical Physics); Vassilevich, D.V. International Centre for Theoretical Physics, Trieste (Italy). Sep 1989. 7p. Order Number DE90610477. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

It is shown within the induced quantum gravity approach that approximate invariance of the vacuum (up to topological terms) under rescaling of background tetrads requires that these tetrads should satisfy the Einstein equation with the Newton and cosmological constants defined by low energy parameters. (author). 7 refs.

6264 (IC–89/285) **Banach C*-algebras not containing a subspace isomorphic to C_0.** Basit, B. International Centre for Theoretical Physics, Trieste (Italy). Sep 1989. 6p. Order Number DE90610428. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

If X is a locally Hausdorff space and $C_0(X)$ the Banach algebra of continuous functions defined on X vanishing at infinity, we showed that a subalgebra A of $C_0(X)$ is finite dimensional if it does not contain a subspace isomorphic to the Banach space C_0 of convergent to zero complex sequences. In this paper we extend this result to noncommutative Banach C*-algebras and Banach* algebras. 10 refs.

6265 (IC–89/300) **Iteration methods for solving nonlinear equations in Frechet spaces.** Nguyen Minh Chuong (International Centre for Theoretical Physics, Trieste (Italy)); Khuat van Ninh. International Centre for Theoretical Physics, Trieste (Italy). Sep 1989. 11p. Order Number DE90610429. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In this paper we study the equation fex + Tx for some classes of operators T. These operators acting in normed spaces or in Frechet spaces, include as special cases the class of monotone operators if the considered spaces are Hilbert ones. The solutions of this equation are obtained by iteration methods with estimates of the rate of convergence. (author). 6 refs.

6266 (IC–89/301) **On the approximative normal values of multivalued operators in topological vector space.** Nguyen Minh Chuong (International Centre for Theoretical Physics, Trieste (Italy)); Khuat van Ninh. International Centre for Theoretical Physics, Trieste (Italy). Sep 1989. 13p. Order Number DE90610430. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In this paper the problem of approximation of normal values of multivalued linear closed operators from topological vector Mackey space into E-space is considered. Existence of normal value and convergence of approximative values to normal value are proved. (author). 4 refs.

6267 (IC–89/302) **Regularization of variational inequalities problems for non monotone and discontinuous perturbed operators.** Nguyen Minh Chuong (International Centre for Theoretical Physics, Trieste (Italy)); Nguyen van Kinh. International Centre for Theoretical Physics, Trieste (Italy). Sep 1989. 15p. Order Number DE90610431. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

We investigate the approximants of a variational inequality for non monotone and discontinuous perturbed operators. 13 refs.

6268 (IC–89/303) **Newton Seidel method for quasilinear operator equations in supermetric spaces.** Nguyen Minh Chuong (International Centre for Theoretical Physics, Trieste (Italy)); Le Dinh Thinh; Nguyen van Khai. International Centre for Theoretical Physics, Trieste (Italy). Sep 1989. 16p. Order Number DE90610432. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

We investigate a quasilinear operator equation by two Newton-Seidel methods in supermetric spaces showing that in some sense the two methods are in duality. 8 refs.

6269 (IC–89/305) **Projection-iteration methods for solving nonlinear operator equations.** Nguyen Minh Chuong (International Centre for Theoretical Physics, Trieste (Italy)); Tran thi Lan Anh; Tran Quoc Binh. International Centre for Theoretical Physics, Trieste (Italy). Sep 1989. 24p. Order Number DE90610433. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In this paper, the authors investigate a nonlinear operator equation in uniformly convex Banach spaces as in metric spaces by using stationary and nonstationary generalized projection-iteration methods. Convergence theorems in the strong and weak sense were established. (author). 7 refs.

6270 (IC–89/307) **The initial quantum state of matter perturbations about a de Sitter background.** Anini, Y. International Centre for Theoretical Physics, Trieste (Italy). Sep 1989. 5p. Order Number DE90610461. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

In this paper the initial quantum state of a massive scalar field on a de Sitter background is evaluated at small Euclidean three-geometries. For each inhomogeneous mode of the matter field the result is the ground state. This result depends crucially on the fact that the frequency of the modes can be made arbitrarily large by taking the limit of small Euclidean three-geometries. (author). 3 refs.

6271 (IC–89/311) **Nonlinear successive over-relaxation: Extensions and applications.** Uko, U.L. International Centre for Theoretical Physics, Trieste (Italy). Sep 1989. 9p. Order Number DE90610434. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

We give a successive over-relaxation method for the numerical solution of some coupled systems of nonlinear equations. As an application, we show that this method can be used successfully to obtain complete numerical solutions of boundary value problems arising from central force motion. Numerical examples are given. (author). 9 refs.

6272 (IFVE-OTF–88-202) **Note on path integral quantization of hydrogen atom.** Storchak, S.N. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. 10p. Order Number DE90608906. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

For path integrals whose integration measures are generated by stochastic processes of a definite form (Stratonovich-type equations are a local form for stochastic differential equations of these processes) it has been shown that under quantization of hydrogen atom the reparametrization and reduction Jacobians are mutually cancelled. 12 refs.

6273 (IFVE-OTF–88-212) **Classical mechanics on superspace.** Pyatov, P.N.; Razumov, A.V.; Rybkin, G.N. Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij. 1988. 39p. (In Russian). Order Number DE90608907. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Classical mechanics of systems with states described both by commuting and anticommuting variables is presented. Systems with nonsingular lagrangian functions are considered. The approach based on the concept of superspace where standard functions are determined was used. Grassman algebra with an infinite number of generators was used for constructing analysis. 18 refs.

6274 (INP–1304/PL) **The Lie algebra of the post-Galilean relativity group.** Multarzynski, P. Institute of Nuclear Physics, Cracow (Poland). 1986. 21p. Order Number DE90610435. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The Lie algebra of the post-Galilean relativity group is constructed and investigated. 5 refs. (author).

6275 (JINR-R–2-88-373) **Integration method of the Korteweg-de Vries equation with a self consistent source.** Mel'nikov, V.K. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1988. 6p. (In Russian). Order Number DE90610441. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

Submitted to the journal Phys. Lett. A.

It is shown that solutions rapidly decreasing with x of the Korteweg -de Vries equation with a self-consistent source can be found by the inverse scattering method for the one-dimensional Schroedinger operator on a straight line. 3 refs.

6276 (JINR-R–11-88-451) **On compact modifications of the Bauer method for calculating eigenvalues of tridiagonal matrices.** Emel'yanenko, G.A.; Sek, I.E. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation. 1988. 18p. (In Russian). Order Number DE90610436. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Effective correctable (unknown until) Bauer's method modifications (LR-algorithm) for eigenvalue calculations of tridiagonal matrices in the case of all nonzero main angular minors are obtained. 27 refs.

6277 (JINR-R–11-88-452) **The strategy of spectral shifts and the sets of correct methods for calculating eigenvalues of general tridiagonal matrices.** Emel'yanenko, G.A.; Sek, I.E. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation. 1988. 19p. (In Russian). Order Number DE90610437. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Many correctable unknown methods for eigenvalue calculation of general tridiagonal matrices with real elements; criteria of singular tridiagonal matrices; necessary and sufficient conditions of tridiagonal matrix degeneracy; process with boundary conditions according to calculation processes of general upper and lower tridiagonal matrix minors are obtained. 6 refs.

6278 (JINR-R–11-88-453) **On the sets of correct advanced methods for calculating a complete trigonal general matrix spectrum.** Emel'yanenko, G.A.; Sek, I.M. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation. 1988. 19p. (In Russian). Order Number DE90610438. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Many correctable speed-up methods for calculation of complete general tridiagonal matrix spectrum are developed. A new way of speed-up coefficient choice is proposed. 7 refs.

6279 (JINR-R–11-88-598) **On the set of factorization representations of quasitridiagonal matrices in the case of every nonzero (and certain zero) main block angular minors.** Emel'yanenko, G.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation); Rakhmonov, T.T. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation. 1988. 19p. (In Russian). Order Number DE90610439. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The multiplicity of different factorization representations of quasitridiagonal matrices in the case of zero certain main block angular minors are obtained. The theorem on singularity of the quasitridiagonal matrices is proved. 20 refs.

6280 (JINR-R–11-88-599) **On the factorizations of quasitridiagonal matrices with simultaneous account of the data on the upper and low main block angular minors.** Emel'yanenko, G.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation); Rakhmonov, T.T. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation. 1988. 20p. (In Russian). Order Number DE90610440. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The factorization representations of quasitridiagonal matrices with simultaneous account of the data on both the quantities of upper and low main block angular minors, have been obtained. 6 refs.

6281 (JINR-R–17-88-436) **The application of the method of boson variable elimination to the analysis of evolution of some systems interacting with boson fields.** Bogolyubov, N.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics); Lyagushin, S.F. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1988. 11p. (In Russian). Order Number DE90610462. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The application of the method of boson operator elimination are illustrated by the models of Wagner and of superradiance. The relaxation processes for the impurities in crystal with tunnelling and with phonon interaction are examined. The corrections of the standard theory of superradiance in the Markov approximation due to the higher correlations are obtained. 14 refs.; 3 figs.

6282 (JINR-R–17-88-576) **The Bethe anzatz for rotated boundary conditions.** Priezzhev, V.B. Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics. 1988. 11p. (In Russian). Order Number DE90610463. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A method is suggested for derivation of the Bethe ansatz equations for the 6-vertex model on the square lattice rotated by an arbitrary angle with respect of the coordinate axes. The method is based on the random walk representation for configurations of the model. The equations for the simplest case - the ice model, are derived as illustration of the method. 7 refs.; 2 figs.

6283 (Juel–2279) **Electrons on the sphere in the magnetic-monopole field. A study of the Green function in the white-noise potential.** Guenther, R. Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung; Koeln Univ. (Germany, F.R.). May 1989. 141p. (In German). Order Number DE90728790. Available from Available from Kernforschungsanlage Juelich GmbH (Germany, F.R.). Zentralbibliothek.

The disorder averaged Green function of non-interacting electrons in a strong magnetic field is investigated. First the known results for the plane are presented. Reduction to a zero-dimensional system enables to find the exact Green function. The second part generalizes the plane to the surface of a sphere. The unperturbed problem gives representations of SU(2) for the states of the electrons. Using the symmetries of these functions it is possible to construct the exact solution for up to 4 particles; the density of states shows very good agreement with the result for $N = \infty$. Perturbative expansion is investigated for arbitrary particle numbers. Each diagram corresponds to a scalar, composed of Clebsch-Gordan-coefficients. In the limit of high energy the leading behavior of the Green function can be isolated. Finally a perturbative expansion of the leading corrections to the result in the plane is given. (orig.).

6284 (LAFI–140) **Stark effect singularities for highly excited states.** Damburg, R.Ya. AN Latvijskoj SSR, Riga (USSR). Inst. Fiziki. 1988. 26p. (In Russian). Order Number DE90608908. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Regions around the crossing points of the hydrogenic Stark levels are examined for the cases when one of the quantum numbers - n_1 of n_2 - large. It has been shown that for the corresponding electric fields F the Stark effect exhibits qualitative peculiarities which might be experimentally studied. 26 refs.

6285 (LAFI–143) **Soliton-type solutions of the nonlinear solitonics equations in terms of the Weierstrass elliptic functions.** Kashcheev, V.N. AN Latvijskoj SSR, Riga (USSR). Inst. Fiziki. 1988. 18p. (In Russian). Order Number DE90608905. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Similar-type solutions (travelling waves) of the one-dimensional solitonic equations are considered; the differential functions of the latter contain, besides the even derivatives, the odd ones. The solutions of a number of equations are derived in the form of u(x-ct)=4(P)+B(P)P'(x-ct) where A,B are the rational functions, P is the Weierstrass elliptic function.

6286 (SAND–89-2536C) **Brownian trail rectified.** Hurd, A.J.; Ho, P. Sandia National Labs., Albuquerque, NM (USA). 1989. 5p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. (CONF-891119–7: Materials Research Society fall meeting, Boston, MA (USA), 27 Nov - 2 dec 1989). Order Number DE90003339. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The experiments described here indicate when one of Nature's best fractals – the Brownian trail – becomes nonfractal. In most ambient fluids, the trail of a Brownian particle is self-similar over many decades of length. For example, the trail of a submicron particle suspended in an ordinary liquid, recorded at equal time intervals, exhibits apparently discontinuous changes in velocity from macroscopic lengths down to molecular lengths: the trail is a random walk with no velocity "memory" from one step to the next. In ideal Brownian motion, the kinks in the trail persist to infinitesimal time intervals, i.e., it is a curve without tangents. Even in real Brownian motion in a liquid, the time interval must be shortened to $\sim 10^{-8}$s before the velocity appears continuous. In sufficiently rarefied environments, this time resolution at which a Brownian trail is rectified from a

curve without tangents to a smoothly varying trajectory is greatly lengthened, making it possible to study the kinetic regime by dynamic light scattering. Our recent experiments with particles in a plasma have demonstrated this capability. In this regime, the particle velocity persists over a finite "step length" allowing an analogy to an ideal gas with Maxwell-Boltzmann velocities; the particle mass could be obtained from equipartition. The crossover from ballistic flight to hydrodynamic diffusion was also seen. 8 refs., 1 fig.

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Refer also to citation(s) 6490

6287 (DOE/ER/13858–2) **Energy related applications of elementary particle physics: Progress report, March 1, 1989–February 28, 1990.** Rafelski, J. Arizona Univ., Tucson, AZ (USA). Dept. of Physics. 30 Oct 1989. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract FG02-88ER13858. Order Number DE90003533. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Study of muon catalysis of nuclear fusion and phenomena commonly referred to as cold fusion has been central to our effort. Muon catalyzed fusion research concentrated primarily on the identification of energy efficient production of muons, and the understanding and control of the density dependence of auto-poisoning (sticking) of the catalyst. We have also developed the in-flight fusion description of the tμ-d reaction, and work in progress shows promise in explaining the fusion cycle anomalies and smallness of sticking as a consequence of the dominant role of such reactions. Our cold fusion work involved the exploration of numerous environments for cold fusion reactions in materials used in the heavy water electrolysis, with emphasis on reactions consistent with the conventional knowledge of nuclear physics reactions. We then considered the possibility that a previously unobserved ultra-heavy particle X$^-$ is a catalyst of dd fusion, explaining the low intensity neutrons observed by Jones et. al. 29 refs.

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Refer also to citation(s) 5699, 5701, 5784, 6016, 6039, 6040, 6041, 6353, 6358, 6378, 6379, 6415, 6442

6288 (CONF-891106–8-Vugraphs) **Overview of results from the ATF torsatron.** Colchin, R.J. Oak Ridge National Lab., TN (USA). [1989]. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 31. annual meeting of the Division of Plasma Physics of the American Physical Society; Anaheim, CA (USA); 13-17 Nov 1989. Order Number DE90003703. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This viewgraph paper covers the following topics: plasma improvements due to improved impurity control; confinement scaling; edge fluctuations; and bootstrap currents.

6289 (CONF-8910259–3) **Destabilization of tokamak pressure-gradient driven instabilities by energetic alpha populations.** Spong, D.A. (Oak Ridge National Lab., TN (USA)); Holmes, J.A.; Leboeuf, J-N.; Christenson, P.J. Oak Ridge National Lab., TN (USA). [1989]. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From IAEA technical committee meeting on alpha particles/confinement and heating; Kiev (USSR); 23-26 Oct 1989. Order Number DE90003716. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Alpha particle populations can significantly alter existing MHD in stabilities in tokamaks through kinetic effects and coupling to otherwise stable shear Alfven waves. Here we consider resonances of the trapped alpha precessional drift with both the usual ballooning mode diamagnetic frequency ($\omega_{*i}/2$) and the toroidicity induced Alfven eigenmode (TAE). This is examined for noncircular tokamaks in the high-n ballooning limit using an isotropic alpha slowing down distribution and retaining the full energy and pitch angle dispersion in the alpha drift frequency. Applying this to CIT and ITER indicates that ballooning instabilities can persist at B's below the ideal MHD threshold. These are especially dominated by the destabilization of the TAE mode. In addition, a hybrid fluid-particle approach for simulating alpha effects on pressure-gradient driven instabilities is described. 13 refs., 6 figs.

6290 (DOE/ER/51051–T1) **Magnetic mirror confinement concepts system studies: Final report.** InterScience, Inc., Troy, NY (USA). [1989]. 22p. Sponsored by U.S. DOE Energy Research. DOE Contract AC01-84ER51051. Order Number DE90003667. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

This report discusses the following topics: world survey of mirror confinement research facilities; data base on mirror confinement program budget milestone; Fokker-Planck modeling of tandem mirror confinement; review of diagnostic capabilities for tandem mirror research; tandem mirror reactor concept development; tandem mirror data base; and primer on tokamak confinement.

6291 (ENEA-RT-FUS–88-22) **Influence of an energetic ion population on Tokamak plasma stability.** White, R.B.; Romanelli, F.; Bussac, M.N. ENEA, Rome (Italy). May 1989. 27p. Order Number DE90724702. Available from NTIS (US Sales Only), PC A03/MF A01.

Submitted to Physics of Fluids.

The stability of a tokamak plasma to ideal and resistive internal kink modes in the presence of an energetic trapped particle population is analyzed. Domains of stability are found for both slowing-down and Maxellian particle distributions. The stable domains are at moderately high beta plasma and involve a significant but easily obtainable high energy trapped particle density.

6292 (ENEA-RT-FUS–88-29) **Numerical simulation of ion temperature gradient driven turbulence.** Ottaviani, M.; Romanelli, F.; Benzi, R.; Briscolini, M.; Santangelo, P.; Succi, S. ENEA, Frascati (Italy). Centro Ricerche Energia; Rome-2 Univ. (Italy). May 1989. 28p. Order Number DE90724682. Available from NTIS (US Sales Only), PC A03.

Tokamak plasmas are characterized by anomalous thermal and particle fluxes, which are commonly related to the effect of microinstabilities. A particular class of microinstabilities, i.e. modes driven by ion temperature gradients, has been recently proposed to explain the high density saturation of the energy confinement time observed in ohmic discharges. High resolution numerical simulations of plasma turbulence driven by ion temperature gradients in the presence of magnetic field inhomogeneities were performed with a special attention to the behaviour of the anomalous ion energy flux. The pressure gradient evolution is treated consistently with energy transport, allowing for the study of the saturated state in situations of relevance to tokamak plasmas. It is found that the presence of large scale coherent structures significantly affects the turbulent losses, leading to a reduction of the flux with respect to mixing length estimates.

6293 (ENEA-RT-FUS–88-30) **Analysis of collective Thomson scattering for alpha particles diagnostics on tokamaks.** Orsitto, F.P.; Buratti, P. ENEA, Frascati (Italy). Centro Ricerche Energia. May 1989. 20p. Order Number DE90724674. Available from NTIS (US Sales Only), PC A03/MF A01.

Submitted to Nuclear Fusion.

An analysis is carried out of the alpha particles feature of the scattering dynamic form factor in a tokamak configuration. It is shown that the magnetic field in general causes two main effects: (1) a frequency roll-off affects the form factor for small values of the angle PHI between the scattering wavevector and the plane perpendicular to the magnetic field, because the electron mobility depends on this angle, and (2) the form factor exhibits a frequency modulation due the ion cyclotron motion. A constraint is derived on the geometry of the experiment in order to avoid these effects. The ratio Rae, between the alpha and electron signal, dependes on the Salpeter parameter and on the angle PHI. Another constraint on the geometry turns out from the condition Rae greater than 1. The presence of the magnetic field also gives a resonant enhancement of the alpha particles dynamic form factor at the lower hybrid frequency; the role of the resonance is outlined and its connection with the electronic roll-off is discussed. Finally, a discussion is made about the power and geometry requirements that experiments, using a carbon dioxide laser and a 140 GHz gyrotron as sources, should meet in order

to achieve a useful signal-to-noise ratio for the measurement of the alpha particles in the D-T phase of JET (Joint European Torus).

6294 (ETDE-IT–89-33) **Calibration of neutron yield activation measurements at JET.** Pillon, M.; Martone, M.; Jarvis, O.N.; Kallne, J. ENEA, Frascati (Italy). Centro Ricerche Energia. 1988. 28p. Order Number DE90724713. Available from NTIS (US Sales Only), PC A03/MF A01.

Neutron transport calculations were performed using the Monte Carlo particle trajectory sampling method (the MCNP code) in order to determine the neutron fluences and energy distributions at different locations in the JET tokamak. The primary purpose of these calculations was to calibrate the activation measurements used in the determination of the absolute fusion neutron yield from the JET plasma. We present here the calculated neutron activation response coefficients for three different materials used in neutron yield determination for plasmas producing 2.5 and 14 MeV neutrons. The accuracy of the calibration derived from the neutron transport calculation was tested by comparing the present results for the total 2.5 MeV neutron yield with those obtained with calibrated fission chambers: overall agreement at the plus-minus 15% level was demonstrated.

6295 (IAEA-TECDOC–519) **Research using small tokamaks. Proceedings of a technical committee meeting held in Nice, France, 10-11 October 1988.** International Atomic Energy Agency, Vienna (Austria). Jul 1989. 208p. (CONF-8810304–: Technical committee meeting on research using small tokamaks, Nice (France), 10-12 Oct 1988). Order Number DE90607368. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

These proceedings of the IAEA-sponsored meeting held in Nice, France 10-11 October, 1988, contain the manuscripts of the 21 reports dealing with research using small tokamaks. The purpose of this meeting was to highlight some of the achievements of small tokamaks and alternative magnetic confinement concepts and assess the suitability of starting new programs, particularly in developing countries. Papers presented were either review papers, or were detailed descriptions of particular experiments or concepts. Refs, figs and tabs.

6296 (IAEA-TECDOC–519, pp. 23-27) **Production of high poloidal beta tokamak equilibria in the Versator II tokamak by means of RF current drive.** Luckhardt, S.C. (Massachusetts Inst. of Tech., Cambridge, MA (USA). Plasma Fusion Center); Chen, K.I.; Kesner, J.; Kirkwood, R.; Lane, B.; Porkolab, M.; Squire, J. International Atomic Energy Agency, Vienna (Austria). Jul 1989. (CONF-8810304–: Technical committee meeting on research using small tokamaks, Nice (France), 10-12 Oct 1988). In *Research using small tokamaks. Proceedings of a technical committee meeting held in Nice, France, 10-11 October 1988.* Order Number DE90607368. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

Experiments on the Versator II tokamak have been carried out in a regime of low plasma current with the aim of reaching high poloidal beta, β_p. Lower-hybrid RF current drive was used to produce an energetic electron population which carried the plasma current and pressure. In this mode of operation, plasmas with $\epsilon\beta_p$ approaching or exceeding unity could be produced. Data from equilibrium magnetic analysis, hard x-ray, and density profiles display an outward magnetic axis shift in agreement with equilibrium theory, and analysis of the x-ray profile data indicates that q(0) ranges up to approx.= 6. PEST code modeling of these experiments suggests that some of these plasmas may be near or beyond the transition to the second stability region for ballooning modes. (author). 3 refs, 5 figs.

6297 (IAEA-TECDOC–519, pp. 43-49) **Tokamak experiments on JIPP T-IIU.** Ogawa, Y. (Nagoya Univ. (Japan). Inst. of Plasma Physics); Fujita, J.; Hamada, Y. International Atomic Energy Agency, Vienna (Austria). Jul 1989. (CONF-8810304–: Technical committee meeting on research using small tokamaks, Nice (France), 10-12 Oct 1988). In *Research using small tokamaks. Proceedings of a technical committee meeting held in Nice, France, 10-11 October 1988.* Order Number DE90607368. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

With a medium-sized tokamak JIPP T-IIU (R/a=0.91m/0.23m, B_T=3T and I_p=300kA), confinement study for ohmic and auxiliary heated plasmas (P_{ICRF}=2MW, P_{NBI}=0.7MW) has been conducted. To study plasma microturbulences, FIR laser scattering system has been developed with a heterodyne detection. In high density ohmically heated plasmas, low frequency density fluctuations propagating in the ion diamagnetic drift direction (ion mode) have been observed in addition to the electron mode. The injection of ICRF power remarkably enhances both components of the density fluctuations. The pellet was also injected into auxiliary heated plasmas, and it has been observed that the decay of the ion mode just after the pellet injection is much faster than that of the electron mode. This would suggest a stabilization of the ion mode at the peaked density profile produced by the pellet injection. In the JIPP T-IIU tokamak, two toroidally localized m=3 multipole coils are equipped. To demonstrate the concept of the helical island divertor, a pump limiter was inserted into the magnetic island. Experimentally, it is found that, when an island 0-point surrounds the graphite limiter blade, the heat load and plasma recycling at the neutralizer surface behind the limiter increases, and high Z impurities in the plasma are reduced. (author). 7 refs, 4 figs.

6298 (IAEA-TECDOC–519, pp. 67-69) **Equilibrium poloidal beta limit in tokamaks.** Kaw, P.K. (Institute for Plasma Research, Bhat (India)); Kulsrud, R.M.; Cowley, S.C. International Atomic Energy Agency, Vienna (Austria). Jul 1989. (CONF-8810304–: Technical committee meeting on research using small tokamaks, Nice (France), 10-12 Oct 1988). In *Research using small tokamaks. Proceedings of a technical committee meeting held in Nice, France, 10-11 October 1988.* Order Number DE90607368. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The analytical investigation of the flux conserving tokamak equilibrium problem for a large inverse aspect ratio tokamak is presented. The Grad-Shafranov equation is used to demonstrate that beta poloidal has an upper limit of the order of the inverse aspect ratio. (author). 2 refs.

6299 (IAEA-TECDOC–519, pp. 51-59) **Study of plasma passage through a toroidal slot in T-13 tokamak.** Belashov, V.I. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Bortnikov, A.V.; Brevnov, N.N. International Atomic Energy Agency, Vienna (Austria). Jul 1989. (CONF-8810304–: Technical committee meeting on research using small tokamaks, Nice (France), 10-12 Oct 1988). In *Research using small tokamaks. Proceedings of a technical committee meeting held in Nice, France, 10-11 October 1988.* Order Number DE90607368. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

A short survey of experimental activity on small tokamak T-13 is given. The work is related to a scheme of quasi-continuous tokamak operation. The experimental data on plasma column behaviour in the process of its passage through a toroidal slot are presented. (author). 2 refs 14 figs.

6300 (IAEA-TECDOC–519, pp. 61-66) **MHD activity under the influence of helical external magnetic fields.** Nascimento, I.C. (Sao Paulo Univ., SP (Brazil). Inst. de Fisica); Vannucci, A. International Atomic Energy Agency, Vienna (Austria). Jul 1989. (CONF-8810304–: Technical committee meeting on research using small tokamaks, Nice (France), 10-12 Oct 1988). In *Research using small tokamaks. Proceedings of a technical committee meeting held in Nice, France, 10-11 October 1988.* Order Number DE90607368. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The configuration of the intersection of magnetic field lines with a poloidal surface for a plasma column in equilibrium in the small torus TBR-1 is obtained before and after the application of m=2 resonant helical fields (RHF). The results support the interpretation that the RHF actuate on the m=2 mode causing a strong decrease in the MHD activity. (author). 8 refs, 6 figs, 1 tab.

6301 (IAEA-TECDOC–519, pp. 11-21) **High beta plasmas and the second stability regime.** Robinson, D.C. (UKAEA-Euratom Fusion Association, Abingdon (UK). Culham Lab.). International Atomic Energy Agency, Vienna (Austria). Jul 1989. (CONF-8810304–: Technical committee meeting on research using small tokamaks, Nice (France), 10-12 Oct 1988). In *Research using small tokamaks. Proceedings of a technical committee meeting held in Nice, France, 10-11 October 1988.* Order Number DE90607368. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

A number of the key tokamak problems for the future can be addressed on small devices. Among them - the access and operation at the second stability regime. An extensive small tokamak research programme (CLEO, TOSCA and COMPASS devices) has been conducted at Culham Laboratory which includes, as part beta limits, where issues such as access to the second stability region, more extreme forms of plasma shaping, the influence of superthermal particles can be addressed. The methods of obtaining the second stability regime is considered in detail. (author). 11 refs, 12 figs.

6302 (IAEA-TECDOC–519, pp. 29-41) **Second regime tokamak operation at large aspect ratio.** Navratil, G.A. (Columbia Univ., New York, NY (USA). Dept. of Applied Physics and Nuclear Engineering). International Atomic Energy Agency, Vienna (Austria). Jul 1989. (CONF-8810304–: Technical committee meeting on research using small tokamaks, Nice (France), 10-12 Oct 1988). In *Research using small tokamaks. Proceedings of a technical committee meeting held in Nice, France, 10-11 October 1988.* Order Number DE90607368. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

This paper reviews the need for high beta in economic tokamak reactors and summarizes recent results on the scaling of the second regime beta limit for high-n ballooning modes using optimized pressure profiles as well as results on low-n mode stability at the first regime beta limit from the Columbia HBT tokamak. While several experiments have studied ballooning limits using high $\epsilon\beta_p$ plasmas, the most important question for the use of the second stability regime for tokamak reactor improvement is how to achieve these high values of $\epsilon\beta_p$ while at the same time increasing the value of beta to several times the Troyon beta limit. An approach to the study of this key question on beta limits using modest sized, large aspect ratio tokamaks is described. (author). 28 refs, 7 figs, 1 tab.

6303 (IAEA-TECDOC–519, pp. 71-79) **Stability of ballooning modes in the presence of a toroidal flow.** Sen, A. (Institute for Plasma Research, Bhat (India)); Sundaram, A.K. International Atomic Energy Agency, Vienna (Austria). Jul 1989. (CONF-8810304–: Technical committee meeting on research using small tokamaks, Nice (France), 10-12 Oct 1988). In *Research using small tokamaks. Proceedings of a technical committee meeting held in Nice, France, 10-11 October 1988.* Order Number DE90607368. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The stability of high (m,n) ideal ballooning modes in the presence of a rigid toroidal flow is examined. Equilibrium modifications induced by centrifugal forces are found to stabilize the ballooning modes in all but the outer regions of the plasma. Plasma rotation can be of help in gaining access to the second stability regime. (author). 29 refs, 1 fig.

6304 (IAEA-TECDOC–519, pp. 81-101) **High beta plasma self-stabilization and access to the second stability regime.** Demchenko, V.V. (International Atomic Energy Agency, Vienna (Austria). Div. of Physical and Chemical Sciences). International Atomic Energy Agency, Vienna (Austria). Jul 1989. (CONF-8810304–: Technical committee meeting on research using small tokamaks, Nice (France), 10-12 Oct 1988). In *Research using small tokamaks. Proceedings of a technical committee meeting held in Nice, France, 10-11 October 1988.* Order Number DE90607368. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The shear-induced instability of ideal and resistive ballooning MHD modes is studied analytically for closed magnetic traps with an arbitrary shape of the magnetic axis. A stability criteria determining the maximum pressure of an MHD stable plasma for a wide range of toroidal configurations are derived by using the method of small oscillations. The simple ballooning mode transport model is used for self-consistent investigation of the self-stabilization effect on the high-pressure plasma confinement in a conventional tokamak with auxiliary heating. (author). 25 refs, 2 figs, 1 tab.

6305 (IAEA-TECDOC–519, pp. 103-110) **Status of the Phaedrus-T tokamak and the Phaedrus program.** Hershkowitz, H. (Wisconsin Univ., Madison, WI (USA). Dept. of Nuclear Engineering and Engineering Physics). International Atomic Energy Agency, Vienna (Austria). Jul 1989. (CONF-8810304–: Technical committee meeting on research using small tokamaks, Nice (France), 10-12 Oct 1988). In *Research using small tokamaks. Proceedings of a technical committee meeting held in Nice, France, 10-11 October 1988.* Order Number DE90607368. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The middle sized Phaedrus-T tokamak, now under construction, and the Phaedrus Program are described. The Phaedrus-T tokamak will employ 3-4 MW of ICRF, Alfven wave power, to study edge effects, ponderomotive effects, mode control and mode conversion. The Phaedrus Program also will continue to employ the Phaedrus-B tandem mirror to study ICRF effects. (author). 8 refs, 6 figs, 1 tab.

6306 (IAEA-TECDOC–519, pp. 111-123) **Preliminary design of a small aspect ratio tokamak.** Ludwig, G.O. (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, SP (Brazil)); Montes, A.; Sakanaka, P.H. International Atomic Energy Agency, Vienna (Austria). Jul 1989. (CONF-8810304–: Technical committee meeting on research using small tokamaks, Nice (France), 10-12 Oct 1988). In *Research using small tokamaks. Proceedings of a technical committee meeting held in Nice, France, 10-11 October 1988.* Order Number DE90607368. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The preliminary conceptual design of a small aspect ratio tokamak is presented. This tokamak is based upon the spherical torus concept and will be the prototype (PROTO-ETA) of the Brazilian Advanced Tokamak Experiment (ETA). The device parameters are derived from engineering and empirical physical constraints. The tentative parameter values are aspect ratio A < or approx. 1.8, major radius R_0=0.36 m, vacuum toroidal magnetic field on axis B_0=0.65 T and toroidal plasma current I_p=0.38 MA for an edge safety factor q_a=4.5. A simplified zero dimensional model is employed to predict plasma performance and auxiliary heating requirements. RF-assisted startup and noninductive current drive techniques are envisaged. This study results in a device design based on conservative assumptions which, when built up, should allow the investigation of high beta tokamak operation in the first stability regime. (author). 11 refs, 3 figs, 1 tab.

6307 (IAEA-TECDOC–519, pp. 125-133) **TMR - a tokamak for Alfven heating and current drive research.** Kirov, A.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Sukhumi (USSR). Fiziko-Tekhnicheskij Inst.); Medun, V.D.; Ruchko, L.F. and others. International Atomic Energy Agency, Vienna (Austria). Jul 1989. (CONF-8810304–: Technical committee meeting on research using small tokamaks, Nice (France), 10-12 Oct 1988). In *Research using small tokamaks. Proceedings of a technical committee meeting held in Nice, France, 10-11 October 1988.* Order Number DE90607368. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The conceptual design of a small-scale tokamak TMR is presented. The tentative parameter values are the aspect ration A <= 5, major radius R = 0.55 m, toroidal magnetic field on axis B_0 = 2.5T and toroidal current I_p = 100 kA,. RF heating and current sustainment system techniques are envisaged. Alfven wave heating is chosen as a main method for auxiliary heating in TMR tokamak. (author). 3 refs, 4 figs.

6308 (IAEA-TECDOC–519, pp. 185-195) **Recent results from SK/CG-1 machine.** Sinman, A. (Ankara Nuclear Research and Training Centre (Turkey). Nuclear Fusion Lab.); Sinman, S. International Atomic Energy Agency, Vienna (Austria). Jul 1989. (CONF-8810304–: Technical committee meeting on research using small tokamaks, Nice (France), 10-12 Oct 1988). In *Research using small tokamaks. Proceedings of a technical committee meeting held in Nice, France, 10-11 October 1988.* Order Number DE90607368. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

Detailed measurements of a spheromak plasma formation at SK/CG-1 device was performed. The plasma configuration has been produced by the C-gun - a novel version of a magnetically driven shock tube. The comparison between the drift wave and the usual spheromak schemes has shown that the compact torus, in different configurations, can be formed depending upon the operational, modes of the C-gun. By means of the analysis of density profiles, the magnetic field configuration, etc., the formation conditions were determined, taking into account the helicity injection and current drive mechanisms. (author). 9 refs, 6 figs.

6309 (IAEA-TECDOC–519, pp. 197-206) **Preliminary results of the investigation of slow minor radius compression on HT-6B tokamak.** He Yexi (Academia Sinica, Hefei, AH (China). Inst. of Plasma Physics); Zhang Cheng; Xie Jikang and others. International Atomic Energy Agency, Vienna (Austria). Jul 1989. (CONF-8810304–: Technical committee meeting on research using small tokamaks, Nice (France), 10-12 Oct 1988). In *Research using small tokamaks. Proceedings of a technical committee meeting held in Nice, France, 10-11 October 1988.* Order Number DE90607368. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The slow compression along plasma minor radius on HT-6B Tokamak has been studied theoretically and experimentally in a time scale several times longer than the energy confinement time of plasma. There was a good agreement between experiment and theory. The results showed that during slow compression the plasma-wall interaction was reduced, the state of plasma in edge region has been changed, so that plasma confinement was improved efficiently and the plasma parameters were apparently increased. (author). 6 refs, 12 figs, 1 tab.

6310 (IAEA-TECDOC–519, pp. 135-140) **Lithium beam activated edge plasma spectroscopy - recent results and atomic database for quantitative studies.** Aumayr, F. (Technische Univ., Vienna (Austria). Inst. fuer Allgemeine Physik); Schneider, M.; Schweinzer, J.; Winter, H.; Janev, R.K. International Atomic Energy Agency, Vienna (Austria). Jul 1989. (CONF-8810304–: Technical committee meeting on research using small tokamaks, Nice (France), 10-12 Oct 1988). In *Research using small tokamaks. Proceedings of a technical committee meeting held in Nice, France, 10-11 October 1988.* Order Number DE90607368. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

Recent progress in the development of Li-activated charge-exchange spectroscopy for diagnostics of tokamak edge plasmas is described. The status of a proof-of-principle study for Li-CVS at the TEXTOR tokamak at KFA (Juelich, FRG) is outlined. (author). 8 refs, 4 figs.

6311 (IAEA-TECDOC–519, pp. 141-147) **Design and test of a time-of-flight analyzer.** Stoeckl, J. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu); Vetesnik, P.; Jakubba, K.; Zacek, F.; Berezovskij, E.L.; Izvozchikov, A.B. International Atomic Energy Agency, Vienna (Austria). Jul 1989. (CONF-8810304–: Technical committee meeting on research using small tokamaks, Nice (France), 10-12 Oct 1988). In *Research using small tokamaks. Proceedings of a technical committee meeting held in Nice, France, 10-11 October 1988.* Order Number DE90607368. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

A diagnostic technique for the measurement of the energy of fast charge-exchange atoms from magnetically confined plasma is presented. The constructive details and its preliminary test on the stand of the time-of-flight analyzer (TOFAN) are described. The analyzer is proposed for the determination of the ion temperature on the CASTOR tokamak and for the ions energy spectrum resolution at the scrape-off layer of the T-15 tokamak. (author). 8 refs, 5 figs.

6312 (IAEA-TECDOC–519, pp. 149-170) **Tokamak edge plasma investigation by laser blow-off.** Bakos, J.S. (Hungarian Academy of Sciences, Budapest (Hungary). Central Research Inst. for Physics); Buerger, G.; Foeldes, I.B. and others. International Atomic Energy Agency, Vienna (Austria). Jul 1989. (CONF-8810304–: Technical committee meeting on research using small tokamaks, Nice (France), 10-12 Oct 1988). In *Research using small tokamaks. Proceedings of a technical committee meeting held in Nice, France, 10-11 October 1988.* Order Number DE90607368. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The edge plasma density versus plasma radius function of the MT-1 tokamak plasma is measured by a new laser blow-off method. Thin film of sodium evaporated on glass substrate is blown off by a Q-switched ruby laser pulse. The enhanced shortening of the pulse of neutrals was observed along the beam propagation toward the plasma center by measuring the resonance light intensity of atoms excited by the plasma electrons. The density of the plasma is calculated from the measured exponential time decay of the blow-off light pulse without any further calibrating measurement. The measured density distribution of the edge plasma can be fairly well described by parabolical function of the plasma radius innerside near to the limiter radius in consonance with the result of the microwave interferometer measurement. The transport of sodium atoms injected into the plasma using laser blow-off method and that of the intrinsic impurities using deposition probes are investigated. The result of the investigations shows a slight toroidal asymmetry of the fluxes and a similar exponential decay length for fluxes of every kind of particles. The transport process for the intrinsic and nonintrinsic impurities seems to be similar to that of the plasma ions. Measurement of the intensity of the impurity atomic line in the instrumented limited chamber is used for the determination of the impurity containment time. Using the scaling law for the impurity containment time the Z_{eff} can be determined. (author). 21 refs, 8 figs.

6313 (IAEA-TECDOC–519, pp. 171-176) **Atomic iron concentration measurements by laser induced fluorescence in TO-2.** Vukolov, K.Yu. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Shvindt, N.N.; Lider, G.; Venzel, U. International Atomic Energy Agency, Vienna (Austria). Jul 1989. (CONF-8810304–: Technical committee meeting on research using small tokamaks, Nice (France), 10-12 Oct 1988). In *Research using small tokamaks. Proceedings of a technical committee meeting held in Nice, France, 10-11 October 1988.* Order Number DE90607368. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The paper is devoted to a promising diagnostics of impurity atoms in the plasma by means of the laser-induced fluorescence. The experiments on the measurement of Fe-atom concentration in the TO-2 tokamak are described. (author). 6 figs, 1 tab.

6314 (IAEA-TECDOC–519, pp. 177-184) **40 keV neutral lithium beam source for tokamak CASTOR.** Zacek, F. (Ceskoslovenska Akademie Ved, Prague (Czechoslovakia). Ustav Fyziky Plazmatu); Stoeckel, J.; Jakubba, K.; Badalec, J.; Valovic, M.; Kolacek, K. International Atomic Energy Agency, Vienna (Austria). Jul 1989. (CONF-8810304–: Technical committee meeting on research using small tokamaks, Nice (France), 10-12 Oct 1988). In *Research using small tokamaks. Proceedings of a technical committee meeting held in Nice, France, 10-11 October 1988.* Order Number DE90607368. Available from NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS.

The paper deals with the results of two years development of energetic lithium atom source in the IPP Prague. The development was made under Research Contract No. 4551/RB entitled "Lithium beam diagnostics" concluded between the IAEA and IPP Prague. The submitted paper summarizes the results obtained in the frame of this Contract. The source will be used for measurement of the plasma parameters and poloidal magnetic field on the small tokamak CASTOR. (author). 12 refs, 7 figs.

6315 (IC–89/103) **Streaming gravity mode instability.** Wang Shui. International Centre for Theoretical Physics, Trieste (Italy). May 1989. 11p. Order Number DE90610619. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

In this paper, we study the stability of a current sheet with a sheared flow in a gravitational field which is perpendicular to the magnetic field and plasma flow. This mixing mode caused by a combined role of the sheared flow and gravity is named the streaming gravity mode instability. The conditions of this mode instability are discussed for an ideal four-layer model in the incompressible limit. (author). 5 refs.

6316 (IC–89/163) **Generation and radiation of third harmonics by electrostatic wave at a narrow inhomogeneous layer of a warm plasma.** Hussein, A.M. International Centre for Theoretical Physics, Trieste (Italy). Jun 1989. 8p. Order Number DE90610623. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

An investigation is made of wave generation and radiation of third harmonics by electrostatic wave at a narrow inhomogeneous layer of a warm plasma. The amplitudes of the third harmonic waves are calculated. It is found that the amplitude of the third harmonic depends both on the non-linear interaction of the initial waves and on the interaction of second harmonic with the initial wave. (author). 13 refs.

6317 (IC–89/165) **Nonlinear interaction of electrostatic waves at a narrow inhomogeneous layer of a warm magnetoactive plasma.** Hussein, A.M. International Centre for Theoretical Physics, Trieste (Italy). Jul 1989. 7p. Order Number DE90610624. Available from NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS.

An investigation is made of nonlinear interaction of electrostatic waves at a narrow inhomogeneous layer of a warm magnetoactive plasma. The amplitudes of the radiated second-harmonic waves are calculated. The effect of the external magnetic field is to increase the amplitudes of the generated waves. (author). 10 refs.

6318 (IPP–1/247) **A fast numerical algorithmus for thermographic diagnostics.** Mast, K.F.; Wuerz, H. Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.). Jun 1989. 29p. Order Number DE90728986. Available from NTIS (US Sales Only), PC A03/MF A01.

A simple and fast numerical method to evaluate the absorbed energy and power density on the divertor plates of ASDEX and ASDEX-Upgrade is described in this paper. Inertial cooled plates in the Divertor I of ASDEX as well as water-cooled plates in ASDEX-Upgrade and in the Divertor II of ASDEX are considered. In either case the temperature distribution on the surface of a representative divertor plate has to be measured with an appropriate space and time resolution as an input for the numerical computation. The time evolution of the profile of the surface temperature is determined with standard infrared measuring technique (orig./KP).

6319 (IPP–1/248) **Characterizing the edge plasma of different ohmic confinement regimes in ASDEX.** Bessenrodt-Weberpals, M. (Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)); Carlson, A.; Haas, G.; Murmann, H.; Neuhauser, J.; Soeldner, F.X.; Verbeek, H.; Tsois, N.; ASDEX Team. ASDEX Team. Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.). May 1989. 18p. Order Number DE90728987. Available from NTIS (US Sales Only), PC A03/MF A01.

To compare different ohmic confinement regimes in ASDEX, the edge conditions are analyzed in detail. The results show that the improved ohmic confinement comes along with a drop of the separatrix density. This drop allows density profile to peak and seems to be the trigger of a change in the transport. Simultaneously, a universal scaling between the electron temperature and the electron density at the separatrix prevails for all ohmic scenarios. In addition, the total particle flux across the separatrix is evaluated and found to be strongly correlated to the separatrix density. Thus, the associated convective energy loss contributes less to the total energy losses when the confinement is improved. Since the correlations between edge parameters do not change in different ohmic confinement regimes of ASDEX, the edge physics remains about the same. Improved ohmic confinement is then characterized by an optimum separatrix density which provides a sufficient high edge temperature together with low particle fluxes. These optimum conditions then yield the maximum particle confinement. (orig.).

6320 (IPP–2/301) **On vacuum field properties of the URAGAN-2M Torsatron standard configuration.** Bykov, V.E. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.); Shishkin, A.A.; Kisslinger, J.; Rau, F. Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.). Aug 1989. 46p. Order Number DE90729148. Available from NTIS (US Sales Only), PC A03/MF A01.

Vacuum field properties of the URAGAN-2M Torsatron are investigated. In the 'Standard Case', within a certain range of field parameters, the size of the observed magnetic islands at tau = 2/3 can be reduced considerably. Some characteristic quantities for stellarator vacuum fields are reported. (orig.).

6321 (IPP–6/282) **Entropy relaxation of ASDEX plasmas.** Pohl, F. Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.). Sep 1989. 40p. Order Number DE90729147. Available from NTIS (US Sales Only), PC A03/MF A01.

In tokamak discharges with improved ohmic confinement (IOC) in ASDEX a transition is observed from flat density profiles towards more peaked ones, while the normalized temperature profile is preserved. For this behaviour of the radial profiles it is shown that the entropy of the plasma increases during the IOC phase. Hence IOC and entropy relaxation are closely related. If the IOC phase is long enough, one finds stationary plasma states, which are compared with the relaxed state described in theory. (orig.).

6322 (IPP–III/146) **Dimensional analysis of empirical electron heat diffusivities and comparison with microturbulence induced transport.** Becker, G. Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.). Jun 1989. 11p. Order Number DE90728988. Available from NTIS (US Sales Only), PC A03/MF A01.

Empirical scaling laws for the electron heat diffusivity chi_e in the OH, L and H regimes are expressed in dimensionless form. It is found that particle orbit, collisionality and finite beta effects enter in all regimes. The different scalings are shown to result from changes in the finite β contribution, i.e. in magnetic turbulence induced transport. A unified scaling law chi_e proportional to $a^{-1/2}\ A_i^{-1/2}\ n_e^{\alpha-1/2}\ T_e^{\alpha-1/2}\ (q/B_t)^{2\alpha}$ with α=-1/2 (OH) and α=1/2 (L and H) is presented which also holds for the intermediate region between OH and L confinement. Purely electrostatic drift wave models including gyrokinetic effects and collisions yield B_t, A_i and T_e scalings incompatible with the empirical results. Inclusion of electromagnetic effects and pressure-driven terms, e.g. due to resistive ballooning modes, is shown to be necessary. (orig.).

6323 (IPP–III/150) **Measurements of ion temperature at ASDEX with improved fusion proton and triton diagnostics.** Simmet, E.E. Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.). Aug 1989. 83p. (In German). Order Number DE90729146. Available from NTIS (US Sales Only), PC A05/MF A01.

Recently a new diagnostic method was developed on ASDEX to measure the charged fusion products from the reactions d(d,p)t and d(d,n)^{3}He, respectively, with semi-conductor detectors. The protons as well as the tritons could be detected and it was possible to determine the ion-temperature T_i from both of the species using the Doppler contribution to the width of the spectrum of protons and tritons. These measurements and the results, however, are influenced by three different mechanisms: Hard X-rays emitted from the plasma give rise to background counts at a rate which drops about exponentially with the energy. Energy loss of the charged fusion products occurs in thin foils, which are applied to protect the detector from visible light, resulting in energy straggling and profile broadening, especially for too low energy fusion products. Magnetic field changes lead to uncontrolled shifts of the spectra on energy axis, resulting in a statistical spectral broadening. To improve these points, a new shielding was developed, thinner foils to lower energy loss and straggling and a double detector arrangement to subtract the magnetic field effects were applied. Measurements of proton and triton spectra and more accurate determinations of ion-temperatures were possible over a wider range of different ASDEX-discharges. During NI(D^0->D^+)-heated plasmas spectra were found, belonging to non-maxwellian ion-distributions. The described improvements also resulted in first measurements of ^{3}He seen in a tokamak. (orig.).

6324 (IPP–III/151) **The H-mode of ASDEX.** ASDEX Team. ASDEX Team. Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.). Jul 1989. 213p. Order Number DE90729151. Available from NTIS (US Sales Only), PC A10/MF A01.

This paper is a review of the work on the H-mode done on ASDEX since its discovery in 1982. In detail, it presents (1) the development of the plasma profiles - steep edge gradients and flat bulk profiles, (2) the MHD properties resulting from the profile changes, including an extensive stability analysis, (3) the impurity development with special emphasis on the MHD aspects and on neoclassical impurity transport effects in quiescent H-phases, (4) a detailed study of the edge properties including the evidence of 3-dimensional distortions at the edge. The part on confinement encompasses scaling studies and the results of transport analysis. The power threshold of the H-mode is found to depend slightly on the density but hardly on the toroidal field or current. The operational range of the H-mode includes new results on the limiter H-mode of ASDEX and on the development of the H-mode under beam current drive conditions. Several experiments are described which demonstrate the crucial role of the edge electron temperature in the H-mode transition. New material on magnetic and density

fluctuation studies at the plasma edge within the edge transport barrier is presented. Finally, the findings on ADSEX are compared with those on other machines and are used to test various H-mode theories. (orig.).

6325 (LA-UR–89-3687) **Initial results from FRC [field-reversed configuration] compression experiments on FRX-C/LSM.** Rej, D.J. (Los Alamos National Lab., NM (USA)); Barnes, G.A.; Baron, M.H.; Chrien, R.E.; Siemon, R.E.; Slough, J.T.; Taggart, D.P.; Takahashi, T.; Tuszewski, M.; Wright, B.L. Los Alamos National Lab., NM (USA). 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8911130–1: 11. US/Japan workshop on field-reversed configurations and compact toroids, Los Alamos, NM (USA), 7-9 Nov 1989). Order Number DE90003390. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

After more than two years of preparation, high-power FRC compression heating studies are now underway on the Los Alamos FRX-C/LSM facility. Field-reversed configuration plasmas are formed and translated out of the θ-pinch source, and into a compressor where the external B-field can be increased from 0.4 to 2 T in 55 μs. A principal experimental goal is to study FRC confinement at the high energy density, $n(T_e + T_i) \leq 1.0 \times 10^{22}$ keV/m^3, associated with the large external field. In this paper, we report on the first experiments which were performed between April and July, 1989. 9 refs., 5 figs.

6326 (LA-UR–89-3741) **Neutron measurements in the FRX-C/LSM magnetic compression experiment.** Chrien, R.E.; Baron, M.H. Los Alamos National Lab., NM (USA). 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-7405-ENG-36. (CONF-8911130–2: 11. US/Japan workshop on field-reversed configurations and compact toroids, Los Alamos, NM (USA), 7-9 Nov 1989). Order Number DE90003000. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Neutron measurements are being pursued as an ion temperature diagnostic in the FRX-C/LSM Magnetic Compression Experiment. One can easily see that the d-d neutron emission is a sensitive measure of ion heating during adiabatic magnetic compression of FRCs. The reaction rate may be written as $R = (1/2)\ n\ N\ \langle\sigma v\rangle$, where n and N are the deuterium density and inventory. The fusion reactivity varies as $\langle\sigma v\rangle \propto T^{5.6}$ for $T \simeq 1$ keV. For adiabatic compression, $n \propto B^{1.2}$ and $T \propto B^{0.8}$ so $R \propto B^{5.7}$ in the absence of losses. The neutron yield is also sensitive to the time duration that the plasma remains near its peak temperature. 4 refs., 4 figs.

6327 (PPPL–2661) **Heating the Compact Ignition Tokamak (CIT).** Ignat, D.W. Princeton Univ., NJ (USA). Plasma Physics Lab. Nov 1989. 12p. Sponsored by U.S. DOE Energy Research. DOE Contract AC02-76CH03073. Order Number DE90003427. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

The proposed CIT starts operation in the late 1990's with 20 MW of rf heating power. The tokamak and facility are to be designed to accommodate 50 MW auxiliary heating. The heating methods new being considered are ion cyclotron heating (ICH) and electron cyclotron heating (ECH). Aspects of these systems are described, and the choice of power level and type is discussed. 18 refs.

6328 (RAL–89-055) **Energy transport in laser produced plasmas.** Key, M.H. Rutherford Appleton Lab., Chilton (UK). Jun 1989. 91p. Order Number DE90609071. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

To be published in North Holland Handbook of Plasma Physics, vol. 3, 'Physics of Laser Plasmas', eds. S. Witkowski and A. Rubenchik.

The study of energy transport in laser produced plasmas is of great interest both because it tests and develops understanding of several aspects of basic plasma physics and also because it is of central importance in major applications of laser produced plasmas including laser fusion, the production of intense X-ray sources, and X-ray lasers. The three sections cover thermal electrons (energy transport in one dimension, plane targets and lateral transport from a focal spot, thermal smoothing, thermal instabilities), hot electrons (preheating in one dimension, lateral transport from a focal spot) and radiation (preheating in one dimension, lateral transport and smoothing, instabilities). (author).

6329 (UCRL–21247) **Innovative design concepts for the LMF target chamber and related systems: Final report, April 1988–March 1989.** Bourgue, R.F. (General Atomics, San Diego, CA (USA)); Cheng, E.T.; Creedon, R.L.; Schultz, K.R.; Sonn, D.L. Lawrence Livermore National Lab., CA (USA); General Atomics, San Diego, CA (USA). Jun 1989. 115p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (GA-A–19651). Order Number DE90003472. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

We have examined several design concepts for the Laboratory Microfusion Facility (LMF) target chamber, shielding, and final optics protection. The first is an aluminum chamber using the low- density frost protection proposed by LLNL. It employs helium gas cooling, a vacuum for thermal insulation, and a room-temperature water shield. A composite version of the chamber was also explored, which would have low enough activity to allow access within 24 hours (the aluminum requires 7-12 days cooldown). Two versions show promise: a fairly thin woven fiberglass/epoxy chamber and a thick chopped (or powdered) cast glass/epoxy chamber. Another concept used gas puffing to provide a protective gas layer between the target and the wall. Fast values inject enough gas for wall and optic protection yet keep the target region in high vacuum. This concept can also be used in conjunction with final optics protection. Two versions of this were also explored: one with very fast values that fill the optics tubes just before the shot and one with slower, normally-closed valves that prevent gas in pre-filled optics tubes from entering the chamber until just before the shot. Another optics protection idea proposed is to use a condensible gas in the optics tube and cryopump it before it enters the chamber. A bare wall concept discussed is pyramid arrays, which increase the effective wall surface area. The most promising is cast aluminum array panels. 36 refs., 39 figs., 14 tabs.

6330 (UCRL–100359) **Intense REB [relativistic electron beam] transport in a weakly magnetized plasma.** Camacho, J.F.; Poole, B.R.; Chang, B. Lawrence Livermore National Lab., CA (USA). [1989]. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8907168–2: 7. IEEE pulsed power conference, Monterey, CA (USA), 11-14 Jul 1989). Order Number DE90002978. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Intense relativistic electron beams (REBs) have been used in various applications for the purpose of high-power microwave (HPM) generation. By injecting the beam into a plasma, it is possible to overcome the space-charge limiting current because of charge and current neutralization provided by the plasma. Our goal in this experiment was to study beam transport issues which may be relevant to the development of HPM sources which use intense REBs. We conducted high-power REB-plasma interaction experiments by injecting a 1.4 MeV, 25 kA electron beam with $n_b \approx 4 \times 10^{10}$ cm^{-3} into a performed, partially ionized (<1%) argon background situated within a 15 cm ID Lucite tube, with $n_e \sim 10^{11}$ cm^{-3}. Our experimental apparatus consisted of the electron beam accelerator, a plasma source, magnetic field coils, and beam, plasma, and microwave diagnostics. The beam diagnostics included a streak camera and Rogowski coils to measure beam profiles and net current in the system, respectively. A microwave interferometer provided plasma density measurements around the time of the beam-plasma interaction. We also measured RF emission using a microwave spectrometer. These data will be presented. Particle-in-cell code simulations have been performed to help us understand the relevant physics. We shall present the results of these computations. 4 refs., 12 figs.

6331 (UCRL–100805) **The measurement of transport properties in strongly coupled plasmas.** Shepherd, R.L. (Lawrence Livermore National Lab., CA (USA)); Kania, D.R.; Jones, L.A.; Schneider, D.H.; Stewart, R.E. Lawrence Livermore National Lab., CA (USA). Dec 1989. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8908133–8: 24. Yamada conference on strongly coupled plasma physics, Tokyo (Japan), 29 Aug - 2 sep 1989). Order Number DE90003451. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

Transport properties of strongly coupled plasmas are of interest in solid state physics, astrophysics, and high-density plasma physics.

Many theoretical models have been presented to describe transport phenomena in strongly coupled plasmas, however few experiments have been performed to compare with calculations. We present the results of an experiment which measure the low-frequency electron resistivity in a partially degenerate ($1.2 < \Theta < 1.9$), strongly coupled ($0.6 < \Gamma < 1.8$) plasma. In addition, we suggest experiments to measure the stopping power and the energy transport in strongly coupled plasmas. 5 refs., 2 figs.

6332 Current driven instabilities of an electromagnetically accelerated plasma. Chouetri, E.Y.; Kelly, A.J.; Jahn, R.G. vp.Princeton University, Princeton, NJ (US) (1988).

A plasma instability that strongly influences the efficiency and lifetime of electromagnetic plasma accelerators was quantitatively measured. Experimental measurements of dispersion relations (wave phase velocities), spatial growth rates, and stability boundaries are reported. The measured critical wave parameters are in excellent agreement with theoretical instability boundary predictions. The instability is current driven and affects a wide spectrum of longitudinal (electrostatic) oscillations. Current driven instabilities, which are intrinsic to the high-current-carrying magnetized plasma of the magnetoplasmadynmic (MPD) accelerator, were investigated with a kinetic theoretical model based on first principles. Analytical limits of the appropriate dispersion relation yield unstable ion acoustic waves for T(i)/T(e) much less than 1 and electron acoustic waves for T(i)/T(e) much greater than 1. The resulting set of nonlinear equations for the case of T(i)/T(e) = 1, of most interest to the MPD thruster Plasma Wave Experiment, was numerically solved to yield a multiparameter set of stability boundaries. Under certain conditions, marginally stable waves traveling almost perpendicular to the magnetic field would travel at a velocity equal to that of the electron current. Such waves were termed current waves. Unstable current waves near the upper stability boundary were observed experimentally and are in accordance with theoretical predictions. This provides unambiguous proof of the existence of such instabilites in electromagnetic plasma accelerators.

6333 A tandem mirror hybrid plume plasma propulsion facility. Chang-Diaz, F.R.; Yang, T.F.; Krueger, W.A.; Peng, S.; Urbahn, J.; Yao, X.; Griffin, D. vp.Massachusetts Institute of Technolgoy, Cambridge, MA (US) (1988).

A concept in electrodeless plasma propulsion, which is also capable of delivering a variable Isp, is presented. The concept involves a three-stage system of plasma injection, heating, and subsequent ejection through a magnetic nozzle. The nozzle produces the hybrid plume by the coaxial injection of hypersonic neutral gas. The gas layer, thus formed, protects the material walls from the hot plasma and, through increased collisions, helps detach it from the diverging magnetic field. The physics of this concept is evaluated numerically through full spatial and temporal simulations; these explore the operating characteristics of such a device over a wide region of parameter space. An experimental facility to study the plasma dynamics in the hybrid plume was built. The device consists of a tandem mirror operating in an asymmetric mode. A later upgrade of this system will incorporate a cold plasma injector at one end of the machine. Initial experiments involve the full characterization of the operating envelope, as well as extensive measurements of plasma properties at the exhaust. The results of the numerical simulations are described.

6334 Generation and applications of ultrafast x-ray pulses. Falcone, R.W. (California Univ., Berkeley, CA (USA). Dept. of Physics); Murname, M.M.; Kapteyn, H.C. pp. 443 of OSA conference on lasers and electro-optics (1989 Technical Digest series). Optical Society of America, Washington, DC (1989). (CONF-890423–: CLEO '89: conference on lasers and electro optics, Baltimore, MD (USA), 24-28 Apr 1989).

Technical Paper JD2.

The interaction of intense subpicosecond laser pulses with solid targets is of interest for the study of high density plasmas and the production of short pulse x-ray sources. When an intense laser is focused onto the surface of a solid, a high temperature plasma is produced. If the laser pulse is short, the energy can be absorbed by the electrons in an optical skin depth, leading to rapid ionization before significant ablation of the solid occurs. Rapid cooling of hot electrons is expected due to thermal conduction into the underlying cold material, electron energy loss to ions, and expansion. This type of plasma has been studied using a dye laser at 616 nm with a pulse width of 160 fs and an energy of 5 mJ focused to intensities exceeding $10^{16}Wcm^{-2}$ onto a solid target. Streak camera traces of the plasma x-ray emission from a silicon target yield an x-ray pulse width of 2 +- 2 ps. X-ray emission on a time scale of tens of picoseconds was obtained when the short laser pulse was preceded by laser energy on a few nanosecond time scale. The authors interpret the lengthening of the decay time in the presence of long pulse excitation as emission coming from a lower density plasma.

6335 Experiments with explosively-formed fuses in flux-efficient configurations. Goforth, J.H. (Los Alamos National Lab., Los Alamos, NM (US)); Marsh, S.P.; Reinovsky, R.E. pp. 166 of Conference record of the 1988 IEEE international conference on plasma science (abstracts). IEEE Service Center, Piscataway, NJ (1988). (CONF-880651–: IEEE international conference on plasma science, Seattle, WA (USA), 6-8 Jun 1988).

Technical Paper SP28.

Explosively formed fuses (EFF's) are opening switches that use high explosives to rapidly extrude a relatively thick conductor into a cross-section thin enough to behave much like a conventional fuse. These switches have become useful elements in a variety of explosive pulsed power circuits. The authors have reported experiments using these devices to interrupt multi-megampere currents on microsecond time scales. The emphasis in this work is increasing performance by improving flux management in the devices. An important new capability has recently been demonstrated. The primary advantages of the new flux-conserving geometry are efficiency and speed. They demonstrate the operation of an EFF in a configuration where no flux need be lost. The authors compare their experiment to two-dimensional hydrocode calculations. Results of hydrocode calculations and small-scale experiments aimed at controlling dR/dt are presented.

6336 High performance fuse opening switches for magnetic flux compression generator applications. Reinovsky, R.E. (Los Alamos National Lab., Los Alamos, NM (US)); Lindemuth, I.R.; Hodgdon, M.L.; Vorthman, J.E. pp. 160 of Conference record of the 1988 IEEE international conference on plasma science (abstracts). IEEE Service Center, Piscataway, NJ (1988). (CONF-880651–: IEEE international conference on plasma science, Seattle, WA (USA), 6-8 Jun 1988).

Technical Paper 5P29.

Electrically exploded fuses are useful as fast opening switches for use in power conditioning elements in very large or very high energy systems. While fuses have been demonstrated in opening switch applications on large capacitor bank systems with quarter periods of a few microseconds, concern that the ratio of conduction to interruption time in fuses is limited to about a factor of 10 has limited the application of fuses in flux compression generator (FCG) systems which typically operate on timescales up to several hundred microseconds. Optimization conditions exist for fuses in FCG circuits, and experiments are reported which confirm the operation of fuses in relatively long conduction time capacitor bank circuits and in FCG circuits. Implications for the use of fuses as current interrupters in large (10-MJ class) systems are discussed.

6337 Acceptable residual magnetic fields in the background of a gas neutralizer. Fink, J.H. (Lawrence Livermore National Lab., PO Box 5511, L-644, Livermore, CA CA (USA)). vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract W-7405-ENG-48. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

An approximate method is described to evaluate the maximum acceptable residual magnetic field in the background of a neutral beam.

6338 Tokamak nonmaxwellian plasma dynamics in thermonuclear regime. Cotsaftis, M. (CEN - Fontenay aux Roses (FR)). vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

To reach ignition in a Tokamak plasma, large additional power P_{aux} has to be injected in the device on top of the Joule heating $P_{OH}=VI_r$, V the plasma loop voltage, I_r the resistive port of plasma current. Typi-cally $< T >_{JH} \approx 1$ KeV, whereas ignition would require $< T >_{IG} \approx$ 7-10 KeV. To gain this factor 7, one at least should inject additional power $P_{aux} \approx 7P_{OH}$, supposing that nothing, especially the heat transport, is modified. This is by far not the case, with the so-called energy lifetime degradation, largely observed in oil experiments (but less dramatic with divertors), where energy lifetime tau_E behaves like P_{tot}^{-b} with $b \approx 1/2$. In large machines where ignition temperature is the target to be imperiously reached, this implies to inject a very large power, typically $P_{aux} \approx$ 50 to 100 MW, depending on size and parameters and on actual transport. So it is of importance with such figures, or even larger ones owing to uncertain ties, to optimize at best injected power by increasing its efficiency, both with respect to possible transport laws, and to physical phenomena governing heat flow in the system from the sources. This leads to the concept of scenarios, as time sequences of power input, where physical properties of the plasma system are used to build up ion temperature so that ignition is reached with minimum $P_{tot} = P_{OH} + P_{aux}$ and with fixed $Q = Q_o > 1$. Elements for this study are given. The method is outlined. The resulting system of equations describing the evolution of a thermonuclear plasma is given.

6339 **A calorimeter for measuring the neutral beam power reaching the plasma.** Menon, M.M. (Oak Ridge National Lab., PO Box Y, Oak Ridge, TN (USA)); Edmonds, P.H.; Hahs, C.L. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract AC05-84OR21400. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

A calorimeter has been designed to measure the neutral beam power reaching the Advanced Toroidal Facility (ATF) plasma. The high-heat-flux surface of this calorimeter is made of an array of graphite tiles. The calorimeter, which will be located in the adaptor section between the ATF vacuum vessel and the beam line, is retractable so that it can be moved away from the plasma without opening the vacuum vessel during normal ATF operation. Two rows of thermocouples mounted perpendicular to each other allow determination of the beam profile. This paper presents the details of the design and fabrication of the calorimeter.

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Refer also to citation(s) 5211, 5444, 5466, 5681, 5682, 6105, 6106, 6116, 6183, 6187, 6188, 6293, 6320, 6329, 6335, 6336, 6338

6340 (ANL/FPP/TM–244) **Near-surface sputtered particle transport for an oblique incidence magnetic field plasma.** Brooks, J.N. Argonne National Lab., IL (USA). Nov 1989. 17p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE90004422. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Near-surface sputtered particle transport has been analyzed numerically using models of sputtering, sheath parameters, and impurity collisions with a background D-T plasma. Tungsten and carbon sputtering was examined, for tokamak divertor plasma conditions. Redeposited ion parameters computed include the charge state, transit time, energy and angle of incidence. A regime of operation for finite self-sputtering of tungsten has been identified. This regime is broader than previous estimates. Results for energetically sputtered and thermally sputtered carbon are compared. 18 refs., 9 figs., 1 tab.

6341 (CONF-890982–7) **The production of ^{49}V, ^{93}Mo, ^{93m}Nb and other long-lived isotopes in fusion materials with 14 MeV neutrons.** Greenwood, L.R.; Bowers, D.L. Argonne National Lab., IL (USA). [1989]. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From International meeting on neutron activation cross sections for fission and fusion energy applications; Argonne, IL (USA); 11-15 Sep 1989. Order Number DE90003802. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Results are presented for measurements of neutron cross sections for the production of ^{49}V (331 d) from vanadium and for ^{93}Mo (3500 a) and ^{93m}Nb (16 a) from natural and ^{94}Mo-enriched molybdenum targets near 14 MeV. The targets were irradiated at the Rotating Target Neutron Source II to fluences up to 10^{18} n/cm^2. Radiochemical separations were performed to separate the desired nuclides from interferring activities. Activity measurements were then performed using x-ray counting techniques. Results are compared with calculations and the measured cross sections are used to predict the level of these activities in a first-wall fusion reactor material. Previous results are also reviewed for similar measurements of the production of ^{55}Fe, ^{63}Ni, ^{59}Ni, ^{94}Nb, and ^{91}Nb. Comparisons with theoretical calculations suggest possible revisions of the halflives of ^{59}Ni and ^{91}Nb.

6342 (CONF-891007–97) **Thermal and stress analysis of the Faraday shield for the ORNL/TFTR rf antenna.** Hammonds, C.J.; Nelson, B.E.; Walls, J.C.; Hoffman, D.J.; Baity, F.W. Oak Ridge National Lab., TN (USA). [1989]. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 13. international symposium on fusion engineering; Knoxville, TN (USA); 2-6 Oct 1989. Order Number DE90003685. Available from NTIS, PC A02/MF A01; OSTI; INIS.

The rf antenna designed and built by Oak Ridge National Laboratory (ORNL) for the Tokamak Fusion Test Reactor (TFTR) is an ion cyclotron resonance heating antenna operating in the 40- to 80-MHz frequency range with a power output of 4 MW for a 2-s pulse. The antenna was delivered to Princeton in November 1987. A review of the antenna design began in early 1988 to ensure compatibility with D-T operation of TFTR. Owing to the serious consequences of a water leak during D-T operation and to other concerns, it was concluded that the Faraday shield of the antenna should be rebuilt. In addition, because of increased heat loads and more stringent acceptance criteria, a new thermal and stress analysis of the shield was authorized. 1 ref., 8 figs., 5 tabs.

6343 (CONF-891007–98) **Solid breeder blanket option for the ITER conceptual design.** Gohar, Y. (Argonne National Lab., IL (USA)); Attaya, H.; Billone, M.C.; Finn, P.; Majumdar, S.; Turner, L.R.; Baker, C.C.; Nelson, B.E.; Raffray, R. Argonne National Lab., IL (USA). Oct 1989. 6p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 13. IEEE symposium on fusion engineering; Knoxville, TN (USA); 2-6 Oct 1989. Order Number DE90003769. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

A solid-breeder water-cooled blanket option was developed for ITER based on a multilayer configuration. The blanket uses beryllium for neutron multiplication and lithium oxide for tritium breeding. The material forms are sintered products for both material with 0.8 density factor. The lithium-6 enrichment is 90%. This blanket has the capability to accommodate a factor of two change in the neutron wall loading without violating the different design guidelines. The design philosophy adopted for the blanket is to produce the necessary tritium required for the ITER operation and to operate at power reactor conditions as much as possible. At the same time, the reliability and the safety aspects of the blanket are enhanced by the use of a low-pressure coolant and the separation of the tritium purge lines from the coolant system. The blanket modules are made by hot vacuum forming and diffusion bonding a double wall structure with integral cooling channels. The different aspects of the blanket design including tritium breeding, nuclear heat deposition, activation analyses, thermal-hydraulics, tritium inventory, structural analyses, and water coolant conditions are summarized in this paper. 12 refs., 2 figs., 1 tab.

6344 (CONF-891007–100) **The Breeding Blanket Interface (BBI): Recent results for the solid breeder and the aqueous salt solution blanket concepts.** Clemmer, R.G. (Argonne National Lab., IL (USA)); Finn, P.A.; Greenwood, L.R.; Sze, D.K.; Bartlit, J.R.; Sherman, R.; Anderson, J.L.; Yoshida, H.; Naruse, Y.; Enoeda, M.; Okuno, K. Argonne National Lab., IL (USA). Oct 1989. 5p. Sponsored by U.S. DOE Energy Research; Japan Atomic Energy Research Institute. DOE Contract W-31109-ENG-38. From 13. IEEE symposium on fusion engineering; Knoxville, TN (USA); 2-6 Oct 1989. Order Number DE90003808. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The Tritium Systems Test Assembly (TSTA) at Los Alamos is a full-scale facility dedicated to testing tritium processing for fusion

reactors. We are involved in a study of adding a Breeder Blanket Interface (BBI) to the TSTA. The BBI is to test the processing required for the tritium output streams for the various fusion reactor breeder blankets. In the current phase of the study, we are evaluating the characteristics of the output from various breeding blankets types. Emphasis is placed on defining the output stream with respect to H/T ratio, impurity content, and radionuclide content. Reported herein is an assessment for two blanket concepts: solid breeder blanket (ceramic, Li_2O), and aqueous salt solution. 24 refs., 2 figs., 2 tabs.

6345 (CONF-891007–101) **Shielding options for the ITER conceptual design.** Gohar, Y. (Argonne National Lab., IL (USA)); Attaya, H. Argonne National Lab., IL (USA). Oct 1989. 5p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 13. IEEE symposium on fusion engineering; Knoxville, TN (USA); 2-6 Oct 1989. Order Number DE90003765. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

Several shield options were analyzed for the ITER conceptual design to minimize the nuclear responses in the toroidal field (TF) coils. The total nuclear heating in the physics phase and the insulator dose in the technology phase are the most critical parameters in the design process. The first shield option has type 316 stainless steel and water shielding material. Steel and water also serve as structural material and coolant, respectively. The second option is similar to the first except that borated water is used instead of ordinary water. The other two options include a small layer of lead or boron carbide (B_4C) at the back of the shield. The last three shield options were considered to reduce the nuclear heating in the toroidal field coils relative to the steel/water shield. An optimization process was performed taking into consideration the thermal-hydraulics and the engineering requirements to define the shield configuration. A careful integration was performed to calculate the total nuclear heating in the toroidal field coils which account for the neutron wall loading distribution, the change in the shield thickness in the poloidal direction, and the space between the toroidal field coils in the divertor zone. The results show that the steel/water/Pb and the steel/borated-water shield options are very close in terms of the total nuclear heating in the toroidal field coils and the dose in the insulator material. The other two options, steel/water and steel/water/B_4C deposit more nuclear heating in the toroidal field coils. 5 refs., 3 figs., 5 tabs.

6346 (CONF-891204–3) **An investigation of the sensitization behavior of Fe-Mn-Cr austenitic steels.** Bell, G.E.C. (Oak Ridge Associated Universities, Inc., TN (USA)); Tortorelli, P.F.; Kenik, E.A. Oak Ridge National Lab., TN (USA). [1989]. 11p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 4. international conference on fusion reactor materials; Kyoto (Japan); 4-8 Dec 1989. Order Number DE90002719. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Standard chemical immersion (modified Strauss) tests and analytical electron microscopy (AEM) showed that reduced activation austenitic steels based on Fe-20Mn-12Cr-0.25C (wt %) are extremely prone to thermal sensitization and intergranular corrosion because of their high carbon contents and low chromium concentrations. This susceptibility to sensitization after thermal aging, fabrication, or irradiation makes their use in aqueous and other certain environments problematical. Excellent correlation between intergranular corrosion induced by immersion in the acidified $CuSO_4$ solution and the presence of narrow chromium-depleted zones around grain boundaries, as determined by AEM, was found. Due to the need to meet reduced activation requirements, the opportunities to increase the sensitization of fully austenitic Fe-Mn-Cr steels by alloy design are limited. 10 refs., 4 figs., 1 tab.

6347 (CONF-891204–4) **The feasibility of welding of irradiated materials.** Lin, H.T. (Oak Ridge National Lab., TN (USA)); Chin, B.A. Oak Ridge National Lab., TN (USA). [1989]. 13p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 4. international conference on fusion reactor materials; Kyoto (Japan); 4-8 Dec 1989. Order Number DE90002200. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Helium was implanted into solution-annealed (SA) 316 stainless steel, 20% cold-worked (CW) 316 stainless steel and titanium-modified Primary Candidate Alloy (PCA) through tritium decay to levels ranging from 0.18 to 256 appm. Full penetration welds were then made on helium-doped materials using gas tungsten arc welding (GTAW) under fully constrained conditions. Intergranular heat-affected zone (HAZ) cracking was observed in all of the materials containing greater than 1 appm He. Electron microscopy showed that the HAZ cracking originated from the growth and coalescence of grain boundary (GB) helium bubbles. Bubble growth kinetics in the HAZ is explained by stress-enhanced diffusive cavity growth. Results suggest that the propensity for HAZ cracking can be reduced by the preexisting cold-worked structure and by finely-distributed MC precipitates that refine the distribution of helium bubbles and minimize the flow of vacancies in grain boundaries. 16 refs., 3 figs.

6348 (CONF-891204–5) **Compatibility between vanadium-base alloys and flowing lithium: Partitioning of hydrogen at elevated temperatures.** Hull, A.B.; Chopra, O.K.; Loomis, B.; Smith, D. Argonne National Lab., IL (USA). Dec 1989. 18p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 4. international conference on fusion reactor materials; Kyoto (Japan); 4-8 Dec 1989. Order Number DE90003775. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

A major concern in fusion reactor design is possible hydrogen-isotope-induced embrittlement of structural alloys in the neutron environment expected in these reactors. Hydrogen fractionation occurs between lithium and various refractory metals according to a temperature-dependent distribution coefficient, K_H, that is defined as the ration of the hydrogen concentration in the metallic specimen to that in the liquid lithium. In the present work, K_H was determined for pure vanadium and several binary and ternary alloys, and the commercial Vanstar 7. Hydrogen distribution studies were performed in an austenitic steel forced-circulation lithium loop. Equilibrium concentrations of hydrogen in vanadium-base alloys exposed to flowing lithium at temperatures of 350 to 550°C were measured by inert gas fusion techniques and residual gas analysis. Thermodynamic calculations are consistent with the effect of chromium and titanium in the alloys on the resultant hydrogen fractionation. Experimental and calculated results indicate that K_H values are very low; i.e., the hydrogen concentrations in the lithium-equilibrated vanadium-base alloy specimens are about two orders of magnitude lower than those in the lithium. Because of this low distribution coefficient, embrittlement of vanadium alloys by hydrogen in lithium would not be expected. 15 refs., 5 figs., 4 tabs.

6349 (CONF-8909234–2) **Radiation damage calculations for compound materials.** Greenwood, L.R. Argonne National Lab., IL (USA). [1989]. 14p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From Advisory group meeting on nuclear data for radiation damage assessment and related safety aspects; Vienna (Austria); 19-22 Sep 1989. Order Number DE90003803. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Displacement damage calculations can be performed for 40 elements in the energy range up to 20 MeV with the SPECTER computer code. A recent addition to the code, called SPECOMP, can intermix atomic recoil energy distributions for any four elements to calculate the proper displacement damage for compound materials. The calculations take advantage of the atomic recoil data in the SPECTER libraries, which were determined by the DISCS computer code, using evaluated neutron cross section and angular distribution data in ENDF/B-V. Resultant damage cross sections for any compound can be added to the SPECTER libraries for the routine calculation of displacements in any given neutron field. Users do not require access to neutron cross section files. Results are presented for a variety of fusion materials and a new ceramic superconductor material. Future plans and nuclear data needs are discussed. 11 refs., 6 figs., 1 tab.

6350 (EGG-M–89249) **Safety and stability in superconducting magnets.** Herring, J.S. EG and G Idaho, Inc., Idaho Falls, ID (USA). [1989]. 6p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC07-76ID01570. (CONF-891208–21: Winter annual meeting of the American Society of Mechanical Engineers, San

Francisco, CA (USA), 10-15 Dec 1989). Order Number DE90002015. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

The increasing size and field of superconducting magnets required for new applications result in significant stored energy and magnetic forces. The use of superconducting magnets near humans has resulted in standards for limiting occupational exposures to magnetic field. While these standards are unofficial, they have been widely adopted. In addition, development of large magnet sets for the fusion program and for the MHD program has led to experiments on the behavior of shorted and arcing coils under transient conditions. In combination with various code development efforts, these experiments, in the US and Europe, are resulting in criteria for the design of stable coils which can safely discharge their stored energy. 22 refs., 6 tabs.

6351 (ENEA-RT-FUS–88-14, pp. 33-37) **Helium cooled ceramic breeder in tube blanket for a Tokamak reactor. The coaxial poloidal module concept and design.** Anzidei, L. (Associazione EURATOM-ENEA sulla Fusione, Centro Ricerche Energia, Frascati (Italy)); Gallina, M.; Petrizzi, L.; Rado, V.; Simbolotti, G.; Zampaglione, V.; Violante, V.; Bassani, S. ENEA, Frascati (Italy). Centro Ricerche Energia. Dec 1988. (CONF-880929–: 15. symposium on fusion technology, Utrecht (Netherlands), 19-23 Sep 1988). In *Contributions to the 15th symposium on fusion technology (Utrecht, 19-23 Sep 1988).* Order Number DE89609796. Available from NTIS (US Sales Only), PC A03/MF A01.

This paper presents the results of the 3-D stress analysis and neutronics of neutron flux calculations of the helium-cooled ceramic breeder coaxial poloidal blanket modules for a tokamak reactor. The blanket modules form a compliant structure with acceptable values of the thermomechanical stresses. A 3-D value of the tritium breeding ratio of 1.22 was calculated.

6352 (ENEA-RT-FUS–88-14, pp. 27-31) **First wall for NET. Engineering studies, mockup design and manufacturing.** Franconi, E. (Associazione EURATOM-ENEA sulla Fusione, Centro Ricerche Energia, Frascati (Italy)); Rado, V.; Simbolotti, G.; Violante, V.; Zampaglione, V.; Celentano, F.; Avanzini, P.G.; Brossa, M.; Casali, D.; Grattarola, M. ENEA, Frascati (Italy). Centro Ricerche Energia. Dec 1988. (CONF-880929–: 15. symposium on fusion technology, Utrecht (Netherlands), 19-23 Sep 1988). In *Contributions to the 15th symposium on fusion technology (Utrecht, 19-23 Sep 1988).* Order Number DE89609796. Available from NTIS (US Sales Only), PC A03/MF A01.

In collaboration with ANSALDO and within the framework of the European Fusion Technology Task N1, ENEA (Italian Commission for Alternative Energy Sources) has performed a design and manufacturing feasibility study for the first wall of the Next European Torus (NET) during its 'physics' operation phase. The main design specifications are average neutron wall load equal to 1MW/square meter, peak surface heat flux equal to 0.4MW/square meter, total number of burn pulses equal to $1x10^4$, average burn pulse duration equal to 100 s, average neutron fluence equal to 0.03MWy/square meter, structural material equal to AISI 316L SA, coolant equal to H_2O at 50/100 C (in/out). The reference ENEA/ANSALDO design is based on the use of flat plates coupled by nicrobrazing to poloidal cooling tubes. The technological development work has led to the design and manufacturing of a representative NET first wall box segment (0.65x0.25x0.15 m) mockup which will be tested in the 190 kW Thermal Fatique Test Facility at Joint Research Center (Ispra, Italy). This paper reports on the various aspects of the basic experimental and theoretical investigations on the plasma-wall interaction for adequate protection of the first wall against erosion, global stress analysis of the first wall box, technological tests on brazed joints, and design and manufacturing of the first wall mockup.

6353 (ENEA-RT-FUS–88-21) **Contributions to the 8th international conference on plasma surface interactions in controlled fusion devices, Julich 2-6 May 1988.** ENEA, Frascati (Italy). Centro Ricerche Energia. May 1989. 30p. (CONF-880512–Exc.: 8. international conference on plasma surface interactions in controlled fusion devices, Julich (Germany, F.R.), 2-6 May 1988). Order Number DE90705981. Available from NTIS (US Sales Only), PC A03/MF A01.

Individual papers are processed separately for the data base. (DLC)

6354 (ENEA-RT-FUS–88-21, pp. 5-16) **Deuterium and metal impurities on long-term targets on the FT limiter.** Maddaluno, G. (Associazione EURATOM.ENEA sulla Fusione, Centro Ricerche Energia sulla Fusione, Frascati (Italy)); Martinelli, A.P. ENEA, Frascati (Italy). Centro Ricerche Energia. May 1989. (CONF-880512–Exc.: 8. international conference on plasma surface interactions in controlled fusion devices, Julich (Germany, F.R.), 2-6 May 1988). In *Contributions to the 8th international conference on plasma surface interactions in controlled fusion devices, Julich 2-6 May 1988.* Order Number DE90705981. Available from NTIS (US Sales Only), PC A03/MF A01.

Eight long-term graphite probes mounted on the metal limiter of the FT tokamak were exposed to about 60 ohmically heated deuterium discharges mostly characterized by off-normal events such as disruptions and runaway fluxes. A poloidally and radially asymmetric pattern of both the amount and the shape of the metal converage and the deuterium content was found from the PIXE and NRA surface analyses.

6355 (ENEA-RT-FUS–88-21, pp. 17-28) **Erosion and redeposition behavior of selected NET-candidate materials under high-flux hydrogen : Deuterium plasma bombardment in PISCES.** Franconi, E. (ENEA, Centro Ricerche Energia, Frascati (Italy)); Hirooka, Y.; Conn, R.W.; Leung, K.W.; LaBombard, B.; Nygren, R.E. ENEA, Frascati (Italy). Centro Ricerche Energia. May 1989. (CONF-880512–: 8. international conference on plasma surface interactions in controlled fusion devices, Julich (Germany, F.R.), 2-6 May 1988). In *Contributions to the 8th international conference on plasma surface interations in controlled fusion devices, Julich 2-6 May 1988.* Order Number DE90705981. Available from NTIS (US Sales Only), PC A03/MF A01.

Plasma erosion and redeposition behaviour of selected candidate materials for plasma-facing components in the NET-machine were investigated using the PISCES-A facility. Materials studied include Sic-impregnated graphite, 2D graphite weaves with and without CVD-SiC coatings, and isotropic graphite. These specimens were exposed to continuous hydrogen or deuterium plasmas under the following conditions: electron temperature range from 5 to 35 eV; plasma density range from $5x10^{17}$ to $2x10^{18}$ ions $cm^{minus2}s^{minus1}$; fluence of the order from 10^{21} to 10^{22} ions/square centimeter; bombarding energies of 50 and 100 eV; target temperature range from 300 to 1000 C. The erosion yield of SiC-impregnated graphite due to deuterium plasma bombardment was found to be a factor of 2 to 3 less than that of isotropic graphite materials. A further factor of 2-3- reduction in the erosion yield was observed when redeposition associated with reionization of sputtered particles became significant. From post-bombardment surface analysis with AES, the surface composition in terms of the Si/C of Sic-impregnated graphite ratio was found to increase from 0.15 to 0.7 after hydrogen plasma bombardment to a fluence around $4x10^{21}$ ions/square centimeter at 350 C. However, the final surface composition appeared to remain unchanged up to $4x10^{22}$ ions/square centimeter, the highest fluence in the present study. Significant surface morphological modifications of SiC-impregnated graphite were observed after the high-fluence plasma exposure. Several structural problems were pointed out for SiC-coated 2D graphite weave.

6356 (ENEA-RT-FUS–88-25) **2-D numerical study of the hydrodynamics of laser accelerated foils.** Atzeni, S. ENEA, Frascati (Italy). Centro Ricerche Energia. May 1989. 38p. Order Number DE90724683. Available from NTIS (US Sales Only), PC A03/MF A01.

Submitted to Plasma Physics and Controlled Fusion.

The large scale hydrodynamics of laser accelerated thin disks (foils) is studied numerically using a 2-D, evolutionary Lagrangian fluid code. The considered laser and target parameters are relevant to direct drive laser fusion, in the classical interaction regime. Peculiar 2-D features observed in the experiments are recovered in the simulations; agreement with experimental data is found for a series of experiments concerning foils of different thickness. Scaling laws for the design of hydrodynamically equivalent experiments are tested, with the effects of non-scaled processes turning out to be fairly small, although observable, and qualitatively in agreement with

the relevant theory. Simulations also indicate the adequacy of foil acceleration experiments driven by non-uniform (but controlled) beams to the quantitative study of the smoothing of the irradiation non-uniformities.

6357 (ENEA-RT-FUS–88-26) **NET plasma facing materials behaviour under erosion and redeposition regimes in PISCES.** Franconi, E.; Hirooka, Y.; Conn, R.W.; Leung, K.W.; LaBombard, B.; Nygren, R.E. ENEA, Frascati (Italy). Centro Ricerche Energia; California Univ., Los Angeles, CA (USA). May 1989. 22p. Order Number DE90724678. Available from NTIS (US Sales Only), PC A03/MF A01.

First wall and divertor target plate materials envisaged for the Next European Torus (NET) were investigated in the PISCES-A plasma facility. Since chemical erosion could be quite critical in a machine like NET, SiC-impregnated carbon, 2-D carbon weave, with/without CVD-SiC coatings, and isotropic graphite were studied as alternatives for graphite. Ion bombardment energy ranges from a point at which material eroded from the surface freely escapes the plasma (erosion regime) to conditions in which electron impact ionization is important and redeposition of eroded materials occurs. The NET erosion yield for SiC-impregnated carbon was a factor of 3 below that of isotropic carbon and 2D weave materials when the plasma bombardment was in the erosion mode. A further factor of 2 in reduction in net erosion yield was found when plasma conditions corresponded to the redeposition regime. These reductions in erosion yield relative to carbon materials were found over the temperature range from 300 to 980 C. Post-exposure analysis by AES was used to determine compositional changes on the surface. For SiC-impregnated carbon, the initial atomic composition ratio was 4-6 in terms of C/Si atomic ratio. It was found that at 350 C, carbon was preferentially removed by hydrocarbon formation until chemical composition of the surface came to an equilibrium. The equilibrium surface composition was reached at a fluence around $6x10^{21}$ ions cm^{minus2}, which corresponded to a C/Si ratio of 1.5. This compositional ratio was then maintained to a fluence of $3.6x10^{21}$ ions cm^{minus2}, the highest fluence studied in this experiment.

6358 (ENEA-RT-FUS–88-28) **Tokamaks approaching ignition conditions.** Roccella, M.; Giannella, R. ENEA, Frascati (Italy). Centro Ricerche Energia. May 1989. 49p. Order Number DE90724685. Available from NTIS (US Sales Only), PC A03/MF A01.

Submitted to Fusion Technology.

An analysis (in terms of different figures of merit) of the performances of several recently proposed tokamaks (Ignitor, CIT, Ignitex, JET, En. Tok., NET, Candor) was performed. The analysis was carried out according to different scaling laws and in various operating scenarios (temperature and density profile control, low and high energy confinement modes). In the plasma model, profile consistency between current density and temperature was assumed, taking into account neoclassical conductivity and the related physical constraints. The profiles obtained simulate the experimental data fairly well for both lower and higher collisional plasma. A code was developed for this purpose that produces the stationary state contours for a given tokamak at different additional power levels, once the scaling law is fixed. For a given machine, automatic analyses of these diagrams can be carried out for different confinement scaling laws and operating conditions. Several examples of such analyses are given in the paper. Finally, for a given scaling law and operating scenario, the code scans the configuration space looking for the 'machines' capable of reaching ignition according to some simple technological constraints. The result for the most conservative situation considered here are also shown.

6359 (ENEA-RT-TIB–88-46, pp. 5-13) **Status of the undulator magnet FEL activity at the ENEA Frascati center.** Bizzarri, U. (ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base, U.S. Fisica Applicata); Ciocci, F.; Dattoli, G.; De Angelis, A.; Dipace, A.; Doria, A.; Fiorentino, E.; Giabbai, I.; Giannessi, L.; Giordano, G. ENEA, Frascati (Italy). Centro Ricerche Energia. May 1989. (CONF-8809421–Exc.: Workshop on FEL, Frascati (Italy), 26 Sep 1988). In *Contributions to the one-day informal workshop on FEL (Frascati, 26 Sep 1988).* Order Number DE90705980. Available from NTIS (US Sales Only), PC A03/MF A01.

Paper presented at one-day informal workshop on FEL (Frascati, 26 Sep 1988).

The ENEA-Frascati (Italy) free electron laser (FEL) was designed in order to produce coherent radiation in medium infrared (20 divided by 40 micronm). The device, driven by a 20 MeV circular microtron, utilizes a variable gap permanent magnet (SmCo) undulator. The main parameters of the microtron, the undulator and the optical resonator are summarized in this paper. The large tunability range is achieved both by exploiting the variation of the electron beam energy and the variation of the undulator gap. A feasibility study of a high average power and high efficiency FEL device operating in the millimeter and submillimeter wavelength region is in progress. The main interest in such a radiation source is related to plasma heating technology in magnetic confinement fusion machines through electron cyclotron resonance (ECRH). The main parameters of a laser beam suitable for ECRH are summarized. Two FEL sources are under investigation. One is a MOPA (Master Oscillator Power Amplifier) device, which utilizes an electron beam generated by an induction linac, while the other one is a high power oscillator driven by a radiofrequency (R.F.) linac electron beam. In this second configuration, a good recovery of the electron beam energy, after FEL interaction, is necessary in order to increase the total efficiency of the source (which is quite low for a standard oscillator configuration). Tentative parameters for these two kind of FEL devices are reported.

6360 (ENEA-RT-TIB–88-46, pp. 15-21) **Status of the far-infrared Cerenkov FEL source at the ENEA Frascati Center.** Bizzarri, U. (ENEA, Frascati (Italy). Dipt. Tecnologie Intersettoriali di Base, Divisione Fisica Applicata); Ciocci, F.; Dattoli, G.; De Angelis,.A.; Dipace, A.; Doria, A.; Fiorentino, E.; Giabbai, I.; Giannessi, L.; Giordano, G. ENEA, Frascati (Italy). Centro Ricerche Energia. May 1989. (CONF-8809421–Exc.: Workshop on FEL, Frascati (Italy), 26 Sep 1988). In *Contributions to one-day informal workshop on FEL (Frascati, 26 Sep 1988).* Order Number DE90705980. Available from NTIS (US Sales Only), PC A03/MF A01.

Paper presented at one-day informal workshop on FEL (Frascati, 26 Sep 1988).

A Cherenkov free electron laser (C-FEL) experiment, employing a 5 MeV microtron as electron beam source, is under way at the ENEA (Italian Commission for Alternative Energy Sources) Center of Frascati in cooperation with Dartmouth College, Hanover, USA.Two resonator geometries have been tested. One is a trough waveguide coated with a thin film of polyethylene, having flat metal mirrors placed into the deeper and broader ends of the trough. The trough provides confinement of the radiation in the horizontal plane, but its curved profile introduces losses which are difficult to calculate. The other structure, is a diamond machined double slab copper waveguide with free-standing metal meshes placed at both ends, providing feedback and output coupling. Experimental measurements, together with a Fabry-Perot spectral analysis, indicate a gain mechanism taking place in the resonator at a wavelength of about 3 mm, far from the Cherenkov resonance, probably due to the excitation of fast-wave modes of the guide, which have a better coupling factor to the electron beam cross section than the surface wave, and exhibit lower losses in the resonator. In order to reduce the gain mechanism of this competitive process and to increase the quality factor of the resonator ot the Cherenkov far infrared wavelength, a quasi-optical resonator was designed and is going to be tested.

6361 (ENEA-RT-TIB–89-01) **Hydrogen and water vapor adsorption on lithium aluminate.** Mancini, M.R.; Lojacono, M.; Porta, P.; Alvani, C.; Ciavola, C.; Casadio, S. ENEA, Casaccia (Italy). Centro Ricerche Energia; Rome Univ. (Italy). Mar 1989. 15p. Order Number DE90724688. Available from NTIS (US Sales Only), PC A03.

Lithium oxide and several of its binary or ternary oxides are being investigated for use as breeders for future thermonuclear fusion reactors. The most important property of the breeder materials is the temperature window in which they can release tritium at a sufficient rate (lower temperature limit) without structural damage (higher operating temperature) under service conditions. In this study, volumetric adsorption measurements of hydrogen and water on lithium aluminate material were performed from 100 and 600 degrees C as a function of their pressure. No sizable hydrogen adsorption could

be detected, while, regarding moisture adsorption, the behaviour according to Temkin and Freudlich laws was evidenced, suitable for the quantitative description, with the appropriate best-fitting parameters, of the adsorption equilibrium phenomenology.

6362 (INDC(CCP)–301/GF, pp. 5-13) **Thermonuclear reactors and nuclear data requirements.** Markovskij, D.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii); Orlov, V.V.; Shatalov, G.E.; Sherstnev, K.B. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee; Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii. Jul 1989. (CONF-870959–: 1. international conference on neutron physics, Kiev (USSR), 14-18 Sep 1987). In *Translations from Russian publications of proceedings of the international conference on neutron physics, Kiev, 14-18 September 1987.* Order Number DE90607489. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

After a short presentation of the plasma energy balance in various thermonuclear reactors, the usefulness of accurate measured neutron activation cross-sections for the main components of the structural materials (taking into account the impurities) as well as neutron data for calculating neutron transport and the functionals which determine the fissile isotope, tritium production, energy release, gas release, radiation damage to the blanket materials in hybrid fusion-fission reactors is discussed. 4 refs.

6363 (INDC(NDS)–223/GF) **Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.** Goulo, V. (ed.). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. 262p. (CONF-8905244–: IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna (Austria), 8-11 May 1989). Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The IAEA Nuclear Data Section, in cooperation with national laboratories and other interested institutions, has begun to assemble, process, and test the Fusion Evaluated Nuclear Data Library (FENDL) for use in international (ITER) and national/regional fusion reactor designs. This report includes a summary report on the second IAEA Specialists' Meeting on FENDL convened by the IAEA Nuclear Data Section from 8 to 11 May 1989 in Vienna with the objectives: 1. to analyse a "review kit" of evaluated nuclear data intercomparisons with EXFOR data for the choice of files for FENDL; recommend the next actions with the "review kit", including double differential emission spectra of particles and gamma rays; recommend a verification procedure for processing codes and FENDL application libraries; 2. to review the status of special purpose libraries and plans for their development; 3. to analyse the results of a benchmark comparison for a lead sphere; 4. to discuss plans for future co-operation with national and regional nuclear data centres on the development of FENDL. A number of unpublished papers from the prior specialists' meeting on this subject, held from 14 to 16 November 1987, are included here for convenient reference. (author). Refs, figs and tabs.

6364 (INDC(NDS)–223/GF, pp. 46) **European fusion file project.** Gruppelaar, H. (Netherlands Energy Research Foundation, Petten (Netherlands)). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8905244–: IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna (Austria), 8-11 May 1989). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The European Fusion File (EFF) is a nuclear data file for application in fusion-reactor blanket design calculations, in particular for neutron and photon transport calculations of the Next European Torus (NET). This paper presents the main objectives of the programme for the period 1989 to 1991.

6365 (INDC(NDS)–223/GF, pp. 116-137) **Effect of double-differential lead cross sections in the performance parameters of lead spheres and fusion blankets.** Pelloni, S. (Paul Scherrer Inst. (PSI), Wuerenlingen (Switzerland)). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8905244–: IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna (Austria), 8-11 May 1989). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

Vitamin-J Coupled 175 Neutron-, 42 Photon Group Library is used to calculate the reaction rates in lithium-lead blanket containing 30% ^{6}Li and 90% ^{6}Li in lithium. Tabs.

6366 (INDC(NDS)–223/GF, pp. 185-186) **Comparative study of tritium breeding calculations using EFF-1 and ENDF/B-V based nuclear data libraries.** Pelloni, S. (Paul Scherrer Inst. (PSI), Wuerenlingen (Switzerland)); Cheng, E.T. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8711217–: IAEA Specialists' meeting on the Fusion Evaluated Nuclear Data Library related to the ITER activity, Vienna (Austria), 16-18 Nov 1987). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The reaction rates for tritium breeding in Lithium-Lead BCSS blanket using EFF-1 and ENDF/B-V libraries (for 30% ^{6}Li and 90% ^{6}Li in lithium) are presented.

6367 (KFK–4608) **Numerical calculation of current leads for fusion magnets.** Heller, R. Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Technische Physik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Kernfusion. Aug 1989. 98p. Order Number DE90728840. Available from NTIS (US Sales Only), PC A05/MF A01.

Current leads for high currents up to 50 kA needed for superconducting fusion magnets have to be optimized with respect to heat losses at the cold and warm end to minimize the refrigerator power. Therefore a computer code named CURLEAD was written which solves the one-dimensional heat equation for the current lead and the energy balance for the helium coolant simultaneously. This paper describes the physical models and the mathematics used in this program. Special attention has been given to the discussion of the effect of parameter changes on the heat losses and the temperature distribution as well. (orig.).

6368 (OUP–89-08) **Cold fusion - still an open question.** Rekstad, J.; Kownacki, J.; Tjoem, P.O.; Holter, Oe.; Ingebretsen, F.; Tveter, T.; Osnes, E.; Guttormsen, M. Oslo Univ. (Norway). Fysisk Inst. May 1989. 21p. (In Norwegian). Order Number DE90610627. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The report presents the results from an experiment in search of validation of the reports from the University of Utah claiming cold nuclear fusion in palladium. Heat generation observed during electrolysis of heavy water was observed on the same scale of magnitude as energy release reported by Fleischmann and Pons. However, no foundation was found for the ascription of this energy to fusion. Within the sensitivity of the detector system used, no nuclear effects due to nuclear fusion were observed.

6369 (RISO-M–2771) **Calculation of the gamma radiation levels in and around the NET-DN tokamak reactor.** Hoejerup, C.F. Risoe National Lab., Roskilde (Denmark). Jul 1989. 47p. Order Number DE90610629. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

Calculations of the gamma doses at a TOKAMAK fusion reactor, the NET-DN (1988) are presented. Neutron fluxes in the structures of the reactor are calculated by Monte Carlo methods (MCNP-2) and activations from the neutron induced reactions are determined by the ACTIVA computer programme. By Monte Carlo methods and

the application of an approximative reciprocity principle, the gamma fluxes and doses are finally calculated. (author).

6370 (SAND–89-7111) **Theoretical and computational studies of magnetic insulation and other plasma-opening-switch phenomena.** Lindeman, E.L. Jr. Sandia National Labs., Albuquerque, NM (USA); Mission Research Corp., Los Alamos, NM (USA). Nov 1989. 86p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE90004421. Available from NTIS, PC A05/MF A01 - OSTI; GPO Dep.

This report discusses the following topics: electron trajectories and magnetic insulation; blade-load simulation studies; azimuthal asymmetries; MAGIC simulation studies of a segmented plasma opening switch; PBFA II calculations with different spatial resolution; and analytic solution of the electron current layer in the magnetic front.

6371 (UCID–21748) **A review of Inertial Confinement Fusion (ICF), ICF reactors, and the HYLIFE-II concept using liquid FLiBe.** Moir, R.W. Lawrence Livermore National Lab., CA (USA). 25 Sep 1989. 25p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. Order Number DE90004440. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This paper reviews Inertial Confinement Fusion (ICF) reactor designs and discusses their safety, environmental impact, and economic prospects. The emphasis is on designs carried out at Lawrence Livermore National Laboratory (LLNL) because of the author's familiarity with them; the omission of other designs should not necessarily be taken as disparaging towards those designs. 18 refs., 18 figs., 2 tabs.

6372 (UCRL–97251) **Ion beam inertial fusion: Some issues of interest for applied mathematics.** Mark, J.W.K. Lawrence Livermore National Lab., CA (USA). 17 Aug 1987. 25p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8706404–1: Conference on applied mathematics, Cambridge, MA (USA), 22-24 Jun 1987). Order Number DE90002984. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The goal of ion beam inertial fusion is to accelerate and focus 2–25 megajoules of particle beams at 150–1500 terawatts of peak power and to use them to implode and ignite pellets of DT fusion fuel for energy generation. For Heavy Ion Fusion, the requirements include 15–450 kiloamperes of say thallium ions in low charge state at about 10 GeV of kinetic energy; or for Light Ion Fusion, many megamperes of lithium ions at some tens of MeV kinetic energy. In this paper we point out from this field of research a few topics which, in the author's opinion, could be of interest for applied mathematics, where further development would also be useful. One of these involves numerical simulations of the "statistical-fluids" relevant to the field of highly inhomogeneous nonneutral plasmas (similar to galactic dynamics). Another topic involves issues of geometrical symmetry of axially-placed beam illumination versus spherical implosions of gases in targets; judicious analytical developments could be used to guide simulations of directly driven ion beam targets. 17 refs., 10 figs.

6373 (UCRL–97924) **Long pulse laser-plasma interactions.** Kruer, W.L. Lawrence Livermore National Lab., CA (USA). 18 Dec 1987. 4p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-880110–38: SPIE O-E Lase '88: optoelectronics and laser applications in science and engineering, Los Angeles, CA (USA), 10-17 Jan 1988). Order Number DE90002889. Available from NTIS, PC A02/MF A01 - OSTI.

The absorption of intense laser light in plasmas with a long density scale length can be influenced by many different processes, ranging from collisional absorption to laser-driven instabilities. The mix of these coupling processes depends strongly on the collisionality of the plasma. Optimum coupling is obtained by the use of short wavelength laser light. 16 refs.

6374 (UCRL–98989) **The search for solid state fusion lasers.** Weber, M.J. (Lawrence Livermore National Lab., CA (USA)). Lawrence Livermore National Lab., CA (USA). Apr 1989. 11p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-891220–1: French-Israeli workshop on solid state lasers, Jerusalem (Israel), 12-14 Dec 1989). Order Number DE89012301. Available from NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.

Inertial confinement fusion (ICF) research puts severe demands on the laser driver. In recent years large, multibeam Nd:glass lasers have provided a flexible experimental tool for exploring fusion target physics because of their high powers, variable pulse length and shape, wavelength flexibility using harmonic generation, and adjustable that Nd:glass lasers can be scaled up to provide a single-phase, multi-megajoule, high-gain laboratory microfusion facility, and gas-cooled slab amplifiers with laser diode pump sources are viable candidates for an efficient, high repetition rate, megawatt driver for an ICF reactor. In both applications requirements for energy storage and energy extraction drastically limit the choice of lasing media. Nonlinear optical effects and optical damage are additional design constraints. New laser architectures applicable to ICF drivers and possible laser materials, both crystals and glasses, are surveyed. 20 refs., 2 figs.

6375 (UCRL–99302) **Laser-driven instabilities in long scalelength plasmas, 2.** Kruer, W.L. Lawrence Livermore National Lab., CA (USA). 28 Jul 1988. 17p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8808203–1: 35. Scottish University summer school in physics: laser plasma interactions '88, St. Andrews (UK), 7-20 Aug 1988). Order Number DE90002806. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

There is considerable interest in the interaction of intense laser light with plasmas characterized by a long density scale length. Such plasmas are created in laser fusion applications when targets are irradiated by long shaped pulses of intense laser light. The preferred absorption process is inverse bremsstrahlung, which is simply collisional absorption. However, a hot plasma also supports waves, which correspond to density fluctuations and their self-consistent electric fields. Excitation of these waves can lead to scattering of the laser light and/or to absorption into an undesirable component of energetic electrons which preheat the fuel capsule. A variety of plasma instabilities can be driven by intense laser light in long scale-length plasmas. Most of these instabilities can be represented as the resonant decay of the incident light wave into two other waves. If we neglect self-generated magnetic fields, the plasma will support light waves, electron plasma waves, and ion acoustic waves. Various combinations are apparent. Decay into electron and ion waves takes place near the critical density, where the electron plasma frequency equals the laser light frequency. Decay into two electron plasma waves occurs near .25 n_{cr}. The analogous process involving a scattered light wave plus an ion sound wave can be operative throughout the underdense plasma. Another possible instability is due to long wavelength density modulations which can enhance perturbations in the radial intensity profile of the laser beam. In order to delineate the regimes of efficient coupling, it is important to characterize these various processes. Instabilities which operate in the plasma with density .25 n_{cr} are a particular concern, since collisional absorption can be quite effective at higher densities. 64 refs., 7 figs.

6376 (UCRL–100532) **Design and analysis of a superconducting cable-in-conduit test coil for operation at 15 T and 40 A·mm^{-2}.** Heim, J.R.; Shen, S.S.; Patrick, R.E.; Miller, J.R.; Chaplin, M.R.; Kerns, J.A.; Wong, R.L.; Slack, D.S.; Summers, L.T. Lawrence Livermore National Lab., CA (USA). 24 Aug 1989. 6p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-890850–3: 11. international conference on magnet technology, Tsukuba (Japan), 28 Aug - 1 sep 1989). Order Number DE90002812. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

The International Thermonuclear Experimental Reactor (ITER) Design Team may use coil current densities as high as 40 A·mm^{-2} and peak magnetic fields of 12–15 T to size superconducting coils in a tokamak reactor design. To verify that these values are within the present superconducting magnet technology state-of-the-art, we are building a Proof of Principles (PoP) test coil. The PoP will be inserted into the bore of an existing High-Field Test Facility Solenoid magnet at LLNL. The PoP insert will be a solenoid coil with approximate dimensions of: 1-m, outside diameter; 0.5-m, inside diameter;

about 0.5-m, height. The overall coil fabrication will use the insulate-wind-react-impregnate method. The quartz-cloth-tape insulation material will be wrapped onto the conductor as part of the coil-winding process. The coil will be layer-wound using cable-in-conduit conductor (CICC) with all splices and connections located at the coil ends. The Ti-modified, internal-tin process, MF-Nb_3Sn technique will be used to produce the superconducting composite wire for the CICC. After reaction, the epoxy component of the insulation system will be added by vacuum impregnation. We describe details of the coil design and analysis and relate them to needs within the engineering data base supporting the design of magnet systems for ITER. 5 refs., 8 figs., 1 tab.

6377 (UCRL–101663) **Enhancement of microchannel plate gain by deposition of CsI on the channel walls.** Power, G.; Bonner, R. Lawrence Livermore National Lab., CA (USA). [1989]. 12p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8908185–1: International conference on optical and opto-electronics and applied science, San Diego, CA (USA), 14-18 Aug 1989). Order Number DE90003051. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

At LLNL microchannel plate (MCP) detectors of x-rays have been in use for several years. The voltage is applied by a coating on the MCP which needs to be thick enough that the propagation losses are small. To enhance the gain loss of a thick Au coating CsI is used to enhance the gain and quantum efficiency of the MCP. We have recently discovered that thick coatings of CsI (2 μm) in both the front and back side of the MCP (normal to bias angle) greatly increases the gain. 5 refs., 7 figs.

6378 **Interaction of ultrashort pulses with matter.** Proceedings of the Lebedev Physics Institute, Academy of Sciences of the USSR. Volume 179. Galanin, M.D. 132p. Nova Science Publishers, Inc., Commack, NY (1989).

This book contains the proceedings Lebedev Physics Institute on the Interaction of Ultrashort Pulses with Matter. The topics included are grouped under the following subject categories: Ultrashort pulse generation and amplification in low temperature active media; Automation of optical and x-ray measurements in pulsed laser experiments; and investigation of plasma produced by ultrashort light pulses.

6379 **Numerical simulation and optimal control in plasma physics.** Blum, J. 376p. John Wiley and Sons Inc., New York, NY (1989).

The topics covered in this book are: A free boundary problem: the axisymmetric equilibrium of the plasma in a Tokamak; Static control of the plasma boundary by external currents; Existence and control of a solution to the equilibrium problem in a simple case; Study of equilibrium solution branches and application to the stability of horizontal displacements; Identification of the plasma boundary and plasma current density from magnetic measurements; Evolution of the equilibrium at the diffusion time scale; Evolution of the equilibrium of a high aspect-ratio circular plasma; Stability and control of the horizontal displacement of the plasma.

6380 **Poloidal field coil design code.** Paulson, C.C. (Grumman Aerospace Corp., Space Systems Div. (US)); Todd, A.M.M. pp. 160 of Conference record of the 1988 IEEE international conference on plasma science (abstracts). IEEE Service Center, Piscataway, NJ (1988). (CONF-880651–: IEEE international conference on plasma science, Seattle, WA (USA), 6-8 Jun 1988).

Technical Paper 2A7.

In many cases, plasma cross sections must be specifically tailored in order to obtain second regime access and plasma stability. This paper presents recent progress and results that have been obtained in designing Poloidal Field coil systems utilizing a Greens Function based design code capable of determining the coil locations and currents which are optimum for any given plasma configuration. This code provided the link between the Fixed Boundary Ideal MHD Plasma Equilibrium codes and the corresponding free boundary codes. A flux coordinate fixed boundary code is used to obtain the flux requirements on the plasma surface that allow a stable configuration. The Greens function code is then used to determine the external parameters that will support this result. The code uses the smoothing method originally developed to determine the parameters which provide the flux required and which minimize the flux error and stored energy. Additionally, the derivative of the solution vector and respect to the mixing parameter is minimized to eliminated the spurious dependence that has arisen in previous codes. The code has been checked by utilizing the results obtained as inputs in a free boundary code and has shown remarkable accuracy. To improve flexibility, the code allows the pining of a seperatrix, the setting of limiter flux values or the calculation of optimum limiter flux values, and coil calculations providing specified plasma Volt-Seconds. Examples are provided from the Alacator C-Mod, SRX and PBX-U projects. An approximate analytic form for the determination of the plasma inductance has been determined and is included in the code.

6381 **The IGNITEX fusion project.** Carrera, R. (The Univ. of Texas (US)). pp. 226 of Fusion energy development: Breakeven and beyond. Fusion Power Associates, Gaithersburg, MD (1987). (CONF-870883–: Fusion Power Associates symposium on fusion power development: breakeven and beyond, Princeton, NJ (USA), 27-28 Aug 1987).

The author discusses the recently proposed fusion ignition experiment, IGNITEX. He emphasizes the basic ideas of this concept rather than the specific details of the physics and engineering aspects of the experiment. This concept is a good example of the importance of maintaining an adequate balance between the basic scientific progress in fusion physics and the new technologies that are becoming available in order to make fusion work. The objective of the IGNITEX project is to produce and control ignited plasmas for scientific study in the simplest and least expensive way possible. Being able to study this not-yet-produced regime of plasma operation is essential to fusion research. Two years after the fission nuclear reaction was discovered, a non-self-sustained fission reaction was produced in a laboratory, and in one more year a self-sustained reaction was achieved at the University of Chicago. However, after almost forty years of fusion research, a self-sustained fusion reaction has yet not been produced in a laboratory experiment. This fact indicates the greater difficulty of the fusion experiment. Because of the difficulty involved in the production of a self-sustained fusion reaction, it is necessary to propose such an experiment with maximum ignition margins, maximum simplicity, and minimum financial risk.

6382 **Fusion energy development: Breakeven and beyond. .** Furth, H.P. (Princeton Plasma Physics Lab. (US)). pp. 226 of Fusion energy development: Breakeven and beyond. Fusion Power Associates, Gaithersburg, MD (1987). (CONF-870883–: Fusion Power Associates symposium on fusion power development: breakeven and beyond, Princeton, NJ (USA), 27-28 Aug 1987).

The emphasis in this paper is on experimental fusion research development. In the case of inertial fusion, ignition is the preliminary objective. It is roughly tantamount to break even, in the sense that a barely ignited pellet would give back roughly the energy that you have got to put in initially from the driver system. For the practical reactor application, you would like to get about a hundred times more than that. The possibility that no one guessed in the beginning of fusion research is that one could tamper with the fusion cross-sections themselves. By polarizing the nuclei in the fuel, one could speed up the D-T fusion reaction rate by a factor of one and a half. When you try to reach ignition, the improvement factor is not just fifty percent: its really infinite, because the polarized fuel will ignite at a temperature where the unpolarized fuel does nothing. Particularly discussed is the NET. There are various other versions of this machine, called the INTOR and the ITER. At present, the ITER is the main goal, as a joint international project with the Russians, Europeans and Japanese.

6383 **Results and plans for the Tokamak Fusion Test Reactor.** Meade, D. (Princeton Plasma Physics Lab. (US)). pp. 226 of Fusion energy development: Breakeven and beyond. Fusion Power Associates, Gaithersburg, MD (1987). (CONF-870883–: Fusion Power Associates symposium on fusion power development: breakeven and beyond, Princeton, NJ (USA), 27-28 Aug 1987).

TFTR has recently finished an experimental run using high-power neutral-beam heating. The status of TFTR is summarized. Several data points are shown from TFTR in the high temperature regime produced by neutral-beam-injection heating with temperature now

up to 30 keV and ntau of about $10^{13}cm^{-3}sec$. Also shown are high-density results from pellet injection that have ntau of about 1.5 x $10^{14}cm^{-3}sec$ at 1.5 keV and there are points in between these two extremes. The TFTR objective is to achieve scientific breakeven using deuterium-tritium plasmas where the fusion power output equals the power to heat the plasma (Q=1). The ntau's and T's required to produce this condition are shown. In the high temperature regime the presently achieved ntau will have to be increased by a factor of roughly two to obtain breakeven. The objectives of TFTR when the project was first approved in 1976 are given.

6384 **The Compact Ignition Tokamak.** Schmidt, J. (Princeton Plasma Physics Lab. (US)). pp. 226 of Fusion energy development: Breakeven and beyond. Fusion Power Associates, Gaithersburg, MD (1987). (CONF-870883–: Fusion Power Associates symposium on fusion power development: breakeven and beyond, Princeton, NJ (USA), 27-28 Aug 1987).

The author discusses his lab's plan for completing the Compact Ignition Tokamak (CIT) conceptual design during calendar year 1987. Around July 1 they froze the subsystem envelopes on the device to continue with the conceptual design. They did this by formalizing a general requirements document. They have been developing the management plan and submitted a version to the DOE July 10. He describes a group of management activities. They released the vacuum vessel Request For Proposals (RFP) on August 5. An RFP to do a major part of the system engineering on the device is being developed. They intend to assemble the device outside of the test cell, then move it into the the test cell, install it there, and bring to the test cell many of the auxiliary facilities from TFTR, for example, power supplies.

6385 **Approach to high compression in inertial fusion.** Storm, E. (Lawrence Livermore National Lab. (US)). pp. 226 of Fusion energy development: Breakeven and beyond. Fusion Power Associates, Gaithersburg, MD (1987). DOE Contract W-7405-ENG-48. (CONF-870883–: Fusion Power Associates symposium on fusion power development: breakeven and beyond, Princeton, NJ (USA), 27-28 Aug 1987).

The primary focus of the ICF program at LLNL is the indirect-drive approach with targets of a design that scales to the high-density regime. In the indirect drive approach, energy from the driver beam is absorbed and converted to x-rays, which are contained by a radiation case (or hohlraum) and used to drive the implosion. The principal advantage of this technique is more a symmetric implosion that does not require that the driver beams are uniform or symmetrically arranged. The performance of these targets is excellent; their implosions match our calculations much closer than ever before. Also, this type of target can be efficiently coupled to leading candidate drivers for future reactors. The author shows a limited set of data. He covers the experimental work with the Nova laser that is providing a wealth of information and adding substantially to our understanding of the ICF physics. Nova is, the most sophisticated and flexible laboratory facility every built for studying high-density, high-energy plasma physics. A sophisticated pulse-shaping capability which enables the laser to deliver pulses ranging in duration from 0.1 to about 100 ns is discussed.

6386 **The international thermonuclear reactor (ITER).** Fowler, T.K. (Lawrence Livermore National Lab. (US)); Henning, C.D. pp. 226 of Fusion energy development: Breakeven and beyond. Fusion Power Associates, Gaithersburg, MD (1987). (CONF-870883–: Fusion Power Associates symposium on fusion power development: breakeven and beyond, Princeton, NJ (USA), 27-28 Aug 1987).

Four governmental groups, representing Europe, Japan, USSR and U.S. met in March 1987 to consider a new international design of a magnetic fusion device for the 1990's. An interim group was appointed. The author gives a brief synopsis of what might be thought of as a draft charter. The starting point is the objective of the ITER device, which is summarized as demonstrating both scientific and technical feasibility of fusion. The paper presents an update on the current thinking and technical aspects for the International Thermonuclear Experimental Reactor (ITER). This covers not only what is happening in the U.S. but also some reports of preliminary thinking of the last technical work that occurred in Vienna.

6387 **Evaluation of KRF electron-beam foil materials.** Anderson, R.G. (Lawrence Livermore National Lab., CA (USA)); Tennant, R.A. pp. 443 of OSA conference on lasers and electro-optics (1989 Technical Digest series). Optical Society of America, Washington, DC (1989). (CONF-890423–: CLEO '89: conference on lasers and electro optics, Baltimore, MD (USA), 24-28 Apr 1989).

Technical Paper TUJ44.

The Los Alamos multikilojoule KrF laser system (Aurora) has a requirement for large area foils (up to 1 x 2M) which will survive in a fluorine and e-beam environment for ~1000 shots. Foil selection involves consideration of a wide variety of factors such as availability, thickness uniformity, reflectivity, chemical compatibility, Z-number, density, thermal characteristics, and metallurgical properties, the emphasis of this study is investigating foil properties of a chemical nature. Based on published foil data, three foil materials were selected for testing on a small e-beam test facility: titanium (the foil currently in use on Aurora), inconel 600, and 2024T81 aluminium. Each foil candidate was subjected to 100 shots at a current density of 18 A/cm^2, voltage of 300 kV, and pulse width of 500 ns. These e-gun parameters were chosen to approximate closely the Aurora operating conditions. The fluorine concentration in the gas cell was raised in three steps. For all foils tested, the types and quantities of gaseous reaction products, as determined by chemical and spectroscopic analysis, were essentially the same.

6388 **A nuclear space-based disk MHD power system with very high energy extraction.** Louis, J.F. (Dept. of Aeronautics and Astronautics, MIT (US)); Holman, R.R. pp. 160 of Conference record of the 1988 IEEE international conference on plasma science (abstracts). IEEE Service Center, Piscataway, NJ (1988). (CONF-880651–: IEEE international conference on plasma science, Seattle, WA (USA), 6-8 Jun 1988).

Technical Paper 6A3.

An open cycle space power system obtained by the coupling of a high temperature NERVA derivative nuclear reactor with a special configuration MHD disk generator is discussed. This very compact system uses a minimum size simple magnet configuration and few electrodes. This system is designed to produce no net thrust and to have minimum environmental impact. The main figure of merit for open cycle space power systems is the specific power extracted per unit mass flow of working fluid expressed as MW/kg/s or MJ/kg. A secondary but important figure of merit is the power per system mass (MW/kg). This MHD system can achieve specific power in excess of 20 MW/kg/s or (MJ/kg) with 2900 K hydrogen expanded to high Mach No. through the available high pressure ratio. The performance prediction discussed is based on a conservative evaluation of the present understanding of the non-equilibrium ionized plasma.

6389 **The Madison Symmetric Torus.** Dexter, R.N. (Univ. of Wisconsin-Madison, Madison, WI (US)); Prager, S.C.; Sprott, J.C. pp. 166 of Conference record of the 1988 IEEE international conference on plasma science (abstracts). IEEE Service Center, Piscataway, NJ (1988). (CONF-880651–: IEEE international conference on plasma science, Seattle, WA (USA), 6-8 Jun 1988).

Technical Paper 5P12.

A new reversed field pinch, the Madison Symmetric Torus, MST, is approaching completion. This device was designed for the dual purpose of exploring the basic physics of the RFP boundary configuration and of functioning as a key support experiment for ZTH and RFX. Its moderately large size for present day RFPs, and expected plasma parameter ranges were selected to ensure relevance to programmatic studies. Key design features focussed on flexibility and low magnetic field-error. This paper concentrates on the design, general features of MST, concentrates on the design, general features of MST, special problems encountered, scheduled activities, and present status.

6390 **Inertial fusion in the nineties.** Harris, D. (Univ. of California, Los Alamos National Lab., Los Alamos, NM (US)); Dudziak, D.J.; Cartwright, D.C. vp of Fusion energy development: Breakeven and beyond. Fusion Power Associates, Gaithersburg, MD (1987). (CONF-870883–: Fusion Power Associates symposium on fusion power development: breakeven and beyond, Princeton, NJ (USA), 27-28 Aug 1987).

The 1980s have proven to be an exciting time for the inertial confinement fusion (ICF) program. Major new laser and light-ion drivers

have been constructed and have produced some encouraging results. The 1990s will be a crucial time for the ICF program. A decision for proceeding with the next facility is scheduled for the early 1990s. If the decision is positive, planning and construction of this facility will occur. Depending on the time required for design and construction, this next-generation facility could become operational near the turn of the century.

6391 **Advances in fusion reactor design.** Baker, C.C. (Argonne National Lab. (US)). vp of Fusion energy development: Breakeven and beyond. Fusion Power Associates, Gaithersburg, MD (1987). (CONF-870883–: Fusion Power Associates symposium on fusion power development: breakeven and beyond, Princeton, NJ (USA), 27-28 Aug 1987).

The author addresses the tokamak as a power reactor. Contrary to popular opinion, there are still a few people that think a tokamak might make a good fusion power reactor. In thinking about advances in fusion reactor design, in the U.S., at least, that generally means advances relevant to the Starfire design. He reviews some of the features of Starfire. Starfire is the last major study done of the tokamak as a reactor in this country. It is now over eight years old in the sense that eight years ago was really the time in which major decisions were made as to its features. Starfire was a tokamak with a major radius of seven meters, about twice the linear dimensions of a machine like TIBER.

6392 **Advances in fusion reactor design: The TITAN reversed-field pinch reactor study. .** Najmabadi, F. (Dept. of Mechanical, Aerospace, and Nuclear Engineering, and Institute for Plasma and Fusion Research, Univ. of California, Los Angeles, Los Angeles, CA (US)). pp. 226 of Fusion energy development: Breakeven and beyond. Fusion Power Associates, Gaithersburg, MD (1987). (CONF-870883–: Fusion Power Associates symposium on fusion power development: breakeven and beyond, Princeton, NJ (USA), 27-28 Aug 1987).

TITAN conceptual designs show that high-neutron-wall-loading, compact, and high-mass-power-density fusion systems can be technically feasible and economically attractive even with neutron wall loadings up to 20 MW/m^2; that single-piece maintenance of the FPC is possible and advantageous; that the economics of the reactor is enhanced by its compactness; and the safety and environmental features need not be sacrificed in high-power-density designs.

6393 **Inertial fusion reactor designs.** Meier, W. (W.J. Schafer Associates (US)). pp. 226 of Fusion energy development: Breakeven and beyond. Fusion Power Associates, Gaithersburg, MD (1987). (CONF-870883–: Fusion Power Associates symposium on fusion power development: breakeven and beyond, Princeton, NJ (USA), 27-28 Aug 1987).

In this paper, a variety of reactor concepts are proposed. One of the prime concerns is dealing with the x-rays and debris that are emitted by the target. Internal neutron shielding can reduce radiation damage and activation, leading to longer life systems, reduced activation and fewer safety concerns. There is really no consensus on what the best reactor concept is at this point. There has been virtually no chamber technology development to date. This is the flip side of the coin of the separability of the target physics and the reactor design. Since reactor technology has not been required to do target experiments, it's not being developed. Economic analysis of conceptual designs indicates that ICF can be economically competitive with magnetic fusion, fission and fossil plants.

6394 **Measurement of long-lived radionuclides in fusion materials.** Greenwood, L.R. (Argonne National Lab., IL (USA). Chemical Technology Div.); Bowers, D.L. pp. 798 of Reactor dosimetry: Methods, applications, and standardization. Farrar IV, H.; Lippincott, E.P. ASTM, Philadelphia, PA (1989). (CONF-870501–: 6. ASTM-Euratom symposium on reactor dosimetry: methods, applications, and standardization, Jackson Hole, WY (USA), 31 May - 5 jun 1987).

Neutron cross section measurements are reported for the production of long-lived radionuclides in fusion reactor materials. Samples were irradiated at 14.5 to 14.8 MeV at the RTNSII facility. Long-lived reaction products were detected using gamma and X-ray spectroscopy, liquid scintillation spectrometry, and accelerator mass spectrometry. Radiochemical separations were performed for many samples prior to analysis. Results are summarized for reactions leading to ^{26}Al (720,000 y), ^{53}Mn (3,700,000 y), ^{55}Fe (2.73 y), ^{63}Ni (100 y), ^{59}Ni (76,000 y), ^{91}Nb (700 y), and ^{94}Nb (20,300 y).

6395 **Study of fueling requirements for the engineering test reactor.** Ho, S.K. (Lawrence Livermore National Lab., PO Box 5511, L-644, Livermore, CA (USA)); Perkins, L.J. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract W-7405-ENG-48. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

An assessment of the fueling requirement for the TIBER Engineering Test Reactor is studied. The neutral shielding pellet ablation model with the inclusion of the effects of the alpha particles is used for our study. The high electron temperature in a reactor-grade plasma makes pellet penetration very difficult. The launch length has to be very large (several tens of meters) in order to avoid pellet breakage due to the low inertial strength of DT ice. The minimum repetition rate corresponding to the largest allowable pellet, is found to be about 1 Hz. A brief survey is done on the various operational and conceptual pellet injection schemes for plasma fueling. The underlying conclusion is that an alternative fueling scheme of coaxial compact-toroid plasma gun is very likely needed for effective central fueling of reactor-grade plasmas.

6396 **Engineering study of the neutral beam and RF heating systems for DIII-D, MFTF-B, JET, JT-60 and TFTR.** Lindquist, W.B. (Lawrence Livermore National Lab. (USA)); Staten, S. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract W-7405-ENG-48. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

An engineering study was performed on the rf and neutral beam heating systems implemented for DIII-D, MFTF-B, JET, JT-60, and TFTR. Areas covered include: methodology used to implement the systems, technology, cost, schedule, performance, problems encountered and lessons learned. Systems are compared and contrasted in the areas studied. Summary statements are made on common problems and lessons learned.

6397 **Design of a repeating pneumatic pellet injector for the Joint European Torus.** Milora, S.L. (Oak Ridge National Lab., PO Box Y, Oak Ridge, TN (USA)); Combs, S.K.; Baylor, L.R.; Foust, C.R.; Gethers, F.E.; Sparks, D.O. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract AC05-84OR21400. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

A three-barrel pneumatic pellet launcher developed at Oak Ridge National Laboratory (ORNL) serves as the principal component of a plasma fueling system for the Joint European Torus (JET). The versatile device consists of three independent machine gun-like mechanisms that operate at cryogenic temperatures (14-20K). Individual high-speed extruders provide a continuous supply of solid deuterium to each gun assembly, where a reciprocating breech-side cutting mechanism forms and chambers cylindrical pellets from the extrusion; the deuterium pellets are then accelerated in the gun barrels with controlled amounts of compressed hydrogen gas (pressures up to 100 bar) to velocities of $\leq$1.5 km/s. The injector features three nominal pellet sizes (2.7,4.0, and 6.0 mm) and has been tested at pellet repetition rates of 5,2.5, and 1 Hz, respectively. Each gun can operate (individually or simultaneously) at the design repetition rate for 15-s pulses (limited only by the capacity of the extruder feed system). A remote, stand-alone control and data acquisition system is used for injector operation.

6398 **Target chamber designs for the light ion fusion Target Development Facility.** Peterson, R.R. (Fusion Technology Institute, Univ. of Wisconsin-Madison, 1500 Johnson Drive, Madison, WI (USA)); Engelstad, R.L.; Lovell, E.G.; Moses, G.A. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The light ion fusion Target Development Facility (TDF) would provide a means of testing high gain inertial confinement fusion targets. Construction of the TDF could occur in the mid 1990's. The authors

have designed two target chambers for the TDF, and have analyzed how both target chambers respond to target explosions. One design is optimized for minimum radioactivity induced in the target chamber while the other is of small size and greater simplicity. They show that both designs are credible and discuss the advantages of each.

6399 A configuration study for the TIBER2/ETR tokamak ignition/burn experimental reactor. Neef, W.S. (Lawrence Livermore National Lab., Univ. of California, PO Box 808, Livermore, CA (USA)); Posey, A.E. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

Two major physics decisions had very strong impact on the way that the TIBER2 design is configured for service and maintenance. The first was the choice of three possible operating modes each of which requires a different plasma current. To obtain all desired plasma parameters at all three currents necessitates a particular poloidal field coil arrangement outboard of the torus. The location of those poloidal field coils restricts access to the torus and drastically narrows the choices for removal paths for divertors and blanket test modules. Another decision was to use a double null divertor. The simplicity of symmetry was thereby achieved but divertors must be installed at both top and bottom of the plasma. The resulting coil geometry is shown. Both conductor cross-section and case geometry are shown. In the case of the toroidal field coils a simplified case is shown.

6400 An assessment of the CIT radiation environment using coupled three-dimensional and reduced transport models. Liew, S.L. (Plasma Physics Lab., Princeton Univ., Princeton, NJ (USA)); Ku, L.P. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

Radiation transport models have been created for the nuclear design analysis of the Compact Ignition Tokamak (CIT). The important features of the computational models are discussed. The results of calculations through the coupling between various models are presented. The impact of the hostile radiation environment is assessed.

6401 Compact Ignition Tokamak vacuum vessel closure joint R and D. Hurn, T. (GA Technologies Inc., PO Box 85608, San Diego, CA (USA)); Fisher, M.; Gallix, R.; Hager, E.R.; Boyles, L.; Mishler, H.; Wyide, G. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

Based on the current conceptual design, final closure of the Compact Ignition Tokamak (CIT) vacuum vessel requires two in-situ welds in the poloidal direction. Welding must be performed from the inside of the vacuum vessel because of limited access. The ability to control and predict the amount of weld distortion and the ability to ensure the long-term reliability of these welded joints under cyclic loading is critical. R and D programs are in progress to investigate these issues as well as develop specialized welding equipment to produce these welds. The current status and results are presented.

6402 The High-Density Z-Pinch (HDZP) as a fusion neutron source. Hagenson, R. (Los Alamos National Lab., Los Alamos, NM (USA)); Hammel, J.; Krakowski, R.; Miller, R.; Nebel, R.; Scudder, D.; Werley, K. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

Recent advances in heating (300 eV) and confinement (100-300 sound-transit times) for the constant-radius, ohmically heated high-density Z-pinch (HDZP) suggest a potential for an inexpensive moderate-volume, high-flux fusion neutron source. Depending on the conditions for and length of stable times, measured in terms of the number of sound transit times across the pinch, DT fuel burnups in excess of a percent may be possible to give time-average uncollided neutron fluxes in the range 1-5 MW m^2 over test volumes of ~20-30 liters for pulse rates in the range of ~1-10 Hz.

6403 A DT fusion neutron source based on the reversed-field pinch. Bathke, C.G. (Los Alamos National Lab., Los Alamos, NM (USA)); Krakowski, R.A.; Miller, R.L.; Werley, K.A. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

Results are presented from a preliminary scoping study of an ohmically-heated reversed-field pinch (RFP) operating with a steady-state DT fusion neutron wall loading in the range of 1-5 MW/m^2 while generating less than 100 MW total fusion power. These results are also useful in projecting the development of ignition/burn RFPs, as well as offering an economic source of DT neutrons for fusion nuclear testing.

6404 A lightning protection scheme for the CPRF/ZTH system complex. Konkel, H. (Los Alamos National Lab., Los Alamos, NM (USA)). vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

This paper describes some of the background in the design of the lightning protection and grounding scheme recommended for the CPRF/ZTH system at the Los Alamos National Laboratory. Standard power industry practices were applied to minimize the effect on both the system and personnel of a high magnitude, direct lightning discharge in the CPRF/ZTH area. The recommended scheme is in compliance with existing local and national electric and safety codes.

6405 Preliminary design of the energy system for the ZTH experiment. Boenig, H. (Los Alamos National Lab., Los Alamos, NM (USA)); Gribble, R.; Hammer, C.; Huddleston, S.; Kewish, R.; Konkel, H.; Melton, J.; Reass, W.; Rosev, B.; Thullen, P. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

A 4 MA reversed field pinch experiment, called Zth, is being designed and built at Los Alamos. The first plasma discharges are scheduled to take place in FY 1991. Major electrical power equipment components, such as a pulsed generator, controlled power supplies, isolation and opening switches, current interrupters and capacitor banks are being designed and procured for this experiment. In this paper the requirements and the design philosophy of the components for the energy system are described, and a status report on the component acquisition is given.

6406 Research and development supporting the Compact Ignition Tokamak (CIT). Bushnell, C.W. (Princeton Plasma Physics Lab., Princeton Univ., PO Box 451, Princeton, NJ (USA)). vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract AC02-76CH03073. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The Compact Ignition Tokamak (CIT), a highly-stressed tokamak which will study ignition in a fusion device, has an R and D program that both develops timely design data and produces prototypical hardware and remote handling devices. Approximately half of the $30-35M program now identified supports remote maintenance and repair, both outside and inside the vacuum vessel. However, the largest and most critical tasks at the present time concern fabricating and testing Toroidal Field (TF) and Poloidal Field (PF) conductors to be made by explosively bonding copper to Inconel.

6407 PBX-M shaping field power supplies. Ancher, C.R. (Princeton Plasma Physics Lab., Princeton Univ., PO Box 451, Princeton, NJ (USA)); Pietryga, F. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract AC02-76CH03073. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The Princeton beta experiment (PBX) has been upgraded to facilitate further exploration of the confinement advantages offered by the bean shaped plasma cross section. The machine has been subsequently renamed the PBX-M Tokamak. This revision required adding

six poloidal field power supplies to the machine, appropriately placing conducting plates to enclose the plasma, and the addition of an improved high recycling divertor configuration. Two field coil power supply systems exist: the ohmic heating (OH) system and the equilibrium field (EF) system. This paper briefly describes the general facility layout, the AC power system, and the power supply machine load and places special emphasis on the six new power supplies.

6408 **Photodetachment now.** Fink, J.H. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (USA)). vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract AC03-76SF00098. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

To illustrate the feasibility of photodetachment, the author describes a conceptual design of photo-neutralizers for 0.5 and 3.0 MeV deuterium beams. The negative ions are stripped in optical cavities using large mirrors with higher than 99.99% reflectivity. The neutralizers are illuminated by an array of Nd:YAG slab-lasers emitting about 30 kW/m of light per unit length, while the mirrors are exposed to an irradiance of the order of 100 MW/m^2. Details of the photodetachment cells and the laser configurations have not been resolved.

6409 **Goals, requirements, and desirable characteristics of the LMF inertial fusion driver.** Dudziak, D.J. (Univ. of California, Los Alamos National Lab., PO Box 1663, Los Alamos, NM (USA)); Harris, D.B.; Pendergrass, J.H. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The U.S. Department of Energy (DOE) Office of Inertial Fusion, with the support of the Inertial Confinement Fusion (ICF) laboratories and an industrial contractor, is conducting a preliminary study of a national Laboratory Microfusion Facility (LMF). Included in the study is an examination of the technology needed to develop high-gain targets for ICF commercialization and for support of the nuclear weapons and strategic defense programs. A major goal of the LMF is the generation of target yields on the order of 1 GJ. This paper outlines twenty desirable characteristics of an LMF, along with proposed requirements and goals. Emphasized here are the characteristics and goals for inertial confinement fusion applications of the facility. Some remarks concerning applications to weapons effects and strategic defense research are given.

6410 **Status and near-term plans for DIII-D.** Davis, L.G. (GA Technologies Inc., PO Box 85608, San Diego, CA (USA)); Callis, R.W.; Luxon, J.L.; Stambaugh, R.D. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The DIII-D tokamak at GA Technologies is dedicated to the study of high non-circular plasmas. High beta operation with enhanced energy confinement is paramount among the goals of the DIII-D research program. Commissioning of the device and facility has verified the design capability including coil and vessel loading, volt-second consumption, bakeout temperature, vessel armor, and neutral beamline thermal integrity and control systems performance. Initial experimental results demonstrate that DIII-D is capable of attaining high confinement (H-mode) discharges in a divertor configuration using modest neutral beam heating or ECH. Record values have been achieved with ohmic heating as a first step toward operation at high values of toroidal beta and record values of beta have been achieved using neutral beam heating. This paper summarizes results to date and gives the near term plans for the facility.

6411 **Progress in fusion technology in the U.S. magnetic fusion program.** Dowling, R.J. (Office of Fusion Energy, ER-53, GTN, US Department of Energy, Washington, DC (USA)); Beard, D.S.; Haas, G.M.; Opdenaker, A.L.; George, T.V. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The science and technology required by magnetic fusion research impose a great challenge and the international fusion community has been working very closely together to respond to this challenge. This partnership has resulted in steady progress in fusion research around the world. In this paper the authors discuss the major technological achievements that have taken place during the past few years in the U.S. magnetic fusion program that have contributed to global progress. The goal of the U.S. magnetic fusion program is to establish the scientific and technological base required for fusion energy. To reach this goal, the fusion R and D program, as identified in the Magnetic Fusion Program Plan, is focussed on four key technical issues: determine improved magnetic confinement systems; determine the properties of burning plasmas; develop materials for fusion systems; and establish the nuclear technology of fusion systems.

6412 **The fusion applications and marketing evaluation study (FAME).** Bourque, R.F. (GA Technologies Inc., PO Box 85608, San Diego, CA (USA)); Schultz, K.R. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

Fusion reactors show the promise of being multiproduct: the thermal energy could be used for electricity, synthetic fuels, and process heat; and the neutrons could be used to breed fissile fuel, ^{60}Co, excess tritium, and other radionuclides. Because fusion reactor neutron production could be 10 times that of fission, breeding rates would be high and it is likely that costs of bred material may be quite competitive. Other applications include exploiting the microwave energy from the plasma and deep space power and thrusting. In this paper, estimates are made of the economics of co-production from fusion reactors.

6413 **Space applications of fusion energy: Part I - factors affecting fuel selection. .** Roth, J.R. (Dept. of Electrical and Computer Engineering, Room 409 Ferris Hall, Univ. of Tennessee, Knoxville, TN (USA)). vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

When more than a few hundred kilowatts of steady state power are required for space applications, the only feasible choices appear to be nuclear fission or nuclear fusion. The application of fusion energy to space missions places different and/or more stringent constraints on the choice of fusion reaction than do ground-based electric utility applications. Desirable characteristics of fusion reactions for space include as nearly aneutronic operation as possible; the use of fuels compatible with safety and environmental constraints; ignitibility; and high reactivity. Only the DT,D^{3}He, and cat DD reactions appear capable of operating at power densities in the range from one to ten megawatts per cubic meter, under wall loading and size constraints appropriate for space applications. At this time, the best all-around fusion reaction for space applications appears to be D^{3}He.

6414 **An alternative ETR design based on ICRF/LH heating and current drive.** Mau, T.K. (Institute for Plasma and Fusion Research, Univ. of California, Los Angeles, CA (USA)); Enst, D.A. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

It is proposed to drive a steady-state current with ICRF/LH waves also heat the plasma in an ETR device. A plausible launching scheme using both ICRF fast and LH slow waves has been identified for the TIBER II reactor. In this scheme, absorption by both fuel ions and alphas can be minimized by choosing the right frequency, wave spectrum and launch position. Invoking the bootstrap effect in a peaked density profile, the RF power can be drastically reduced. The resultant current drive efficiencies compare favorable with those of the baseline design which uses neutral beams to drive current.

6415 **Connections between physics and economics for Tokamak fusion power plants.** Krakowski, R.A. (Oak Ridge National Lab., Oak Ridge, TN (USA)); Delene, J.G. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

A simplified physics, engineering, and costing model of a tokamak fusion reactor is used to examine quantitatively the connection between physics performance and power-plant economics based on a DT-fuelled tokamak reactor. Areas where physics and technology advances are needed and where physics/technology tradeoffs exist for attractive end-products are quantitatively identified.

6416 Single-piece maintenance procedures for the TITAN reversed-field pinch reactor. Grotz, S.P. (Dept. of Mechanical, Aerospace and Nuclear Engineering and Institute for Plasma and Fusion Research, Univ. of California, Los Angeles, Los Angeles, CA (USA)); Creedon, R.L.; Cooke, P.I.H.; Duggan, W.P.; Krakowski, R.A.; Najmabadi, F.; Wong, C.vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The TITAN reactor is a compact (major radius of 3.9 m and minor plasma radius of 0.6 m), high neutron wall loading (–18MW/m^2) fusion energy system based on the reversed-field pinch (RFP) concept. The TITAN-I fusion power core (FPC) is a lithium, self-cooled design with vanadium alloy (V-3Ti-1Si) structural material. The compact design of the TITAN fusion power core (FPC) reduces the system to a few small and relatively low mass components, making toroidal segmentation of the FPC unnecessary. A single-piece maintenance procedure in which the replaceable first wall and blanket is removed as a single unit is, therefore, possible. The TITAN FPC design provides for top access to the reactor with vertical lifts used to remove the components. The number of remote handling procedures is few and the movements are uncomplicated. The annual torus replacement requires that the reusable ohmic-heating coil set and hot-shield assembly be removed and temporarily stored in a hot cell. The used first wall and blanket assembly is drained and disconnected from the coolant supply system, then lifted to a processing room where it is cooled and prepared for Class-C waste burial. The new, pre-tested first wall and blanket assembly is then lowered into position and the removal procedure is reversed to complete the replacement process.

6417 Waste disposal ratings in the TITAN RFP reactor. Cheng, E. (TITAN Research Group (USA)); Conn, R.W. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

TITAN, a high-power density, 18.1 MW/m^2 neutron wall loading, lithium self-cooled fusion reactor based on the reversed-field-pinch (RFP) toroidal confinement concept, was analyzed to reveal the waste disposal aspects of such high-power density reactors. It was found that because of the use of V-3Ti-1Si as structural alloy for the first wall, blanket, reflector, and shield components, all the TITAN components except the divertor collector plates can be classified as shallow-land burial (10CFR61 Class C or better) nuclear waste for disposal, provided that the impurity elements, mainly niobium, be controlled below about 1 appm level. The average annual disposal mass was estimated to be 150 tons, about 11% of the total mass in the fusion power core, for producing 1000 MW electric power. The waste disposal rating of the divertor collector plates is estimated to be a factor of 10 higher than for Class C disposal after one full power year operation. The annual disposal mass of this non-Class c waste is 0.35 tons, about 0.23% of the average annual discharge mass. The conclusions derived from the TITAN reactor study are general, and provide strong indications that Class C waste disposal can be achieved for other high-power density approaches to fusion, for example, the tokamak.

6418 Integrated-blanket-coil (IBC) applications to the TITAN reversed-field pinch reactor. Duggan, W.P. (TITAN Research Group, Nuclear Engineering and Engineering Physics Dept., Rensselaer Polytechnic Institute, Troy, NY (USA)); Steiner, D. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The Integrated-Blanket-Coil (IBC) concept has been adopted for use in the toroidal field and divertor coil systems of the TITAN-I lithium/vanadium design. The IBC approach combines the breeding and energy recovery functions of the blanket with the magnetic field production of the coils into a single component. This is accomplished by passing the current through the liquid metal coolant, lithium, which flows poloidally around the plasma. A reversed-field pinch (RFP) reactor offers an attractive context for IBC coils since the low toroidal field at the plasma surface (– 0.36 T) leads to relatively low coil currents. Examination of nuclear, magnetic, thermal-hydraulic, electrical and design integration issues indicates that the IBC coils are a viable and attractive option for the TITAN reactor.

6419 DT and DHe^3 Tokamak test reactor concepts using advanced, high field superconductors. Cohn, D.R. (Plasma Fusion Center, NW16-140, Massachusetts Institute of Technology, Cambridge, MA (USA)); Schwartz, J.; Bieri, R.L.; Bromberg, L.; Williams, J.E.C. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

If practical high temperature superconducting ceramic magnets can be developed, there could be a significant impact on reactor design. Potential advantages include a simpler, more robust magnet design, the possibility of demountable superconducting toroidal field coils and reduced shielding requirements. The high temperature superconductors can also have very high critical fields and could provide super high field operation. This could substantially increase etatau$_E$ values, reduce β requirements, and improve prospects for ohmic heating to ignition. The combination of moderately high β and super high field could make DHe_3 operation possible in a JET size tokamak. In this paper the authors discuss possibilities for test reactor designs using high temperature high field superconductors. An illustrative design has a field at the plasma of 15 T. One possible mode of operation is to use ohmic heating to ignition in a DT plasma followed by thermal runaway to DHe^3 temperatures.

6420 Fuscost: A PC-based menu driven program for economic analysis of fusion facilities. . Musicki, Z. (Fusion Technology Institute, Dept. of Nuclear Engineering and Engineering Physics, Univ. of Wisconsin-Madison, 1500 Johnson Drive, Madison, WI (USA)). vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

An economic analysis program for the IBM-PC computer and using BASICA processor is described. This program is for analysis of fusion facilities, both inertially confined (ICF) and magnetically confined (MFE). The applicable scaling laws and the economic model will be presented here. The program is user-friendly; on-screen menus guide the user and self-explanatory data entry screens with extensive editing capabilities facilitate the data input process. Currently, the program assumes scaling laws for mature technology; it can still be used for comparison purposes for test reactors. It is intended that this program aid in making economic comparisons and not for detailed costing of an actual facility. The program consists of several parts. The scaling laws and the economic model are employed in the actual calculations that the user is interested in. The scaling laws calculate the direct cost of plant equipment, given certain plant parameters. The economic model calculates all the other components of the cost.

6421 TFTR status and plans. Little, R. (Princeton Plasma Physics Lab., Princeton Univ., PO Box 541, Princeton, NJ (USA)). vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract AC02-76CH03073. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

TFTR is performing auxiliary heating experiments with neutral beams as the core of its program for reaching scientific breakeven with deuterium-tritium plasmas. Interesting experimental parameters have been achieved, namely $n_e(o)tau_e = 10^{19} m^{-3}$ s with ion temperatures of 30 keV. Present studies are emphasizing the potential improvement which should occur as plama current is increased towards its design goal of 3 MA. An ICRF system of up to 10 MW capability is being added. At that point in time the basic hardware capability will be complete for D-D operation, and the plan is to achieve plama parameters equivalent to D-T breakeven using D-D in 1988. Emphasis is now shifting to improvement of reliability of

TFTR rather than adding new capabilities unless needed for D-T operations.

6422 **Design issues for a laboratory high gain fusion facility.** Hogan, W.J. (Lawrence Livermore National Lab., Livermore, CA (USA)). vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract W-7405-ENG-48. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

In an inertial fusion laboratory high gain facility, experiments will be carried out with up to 1000 MJ of thermonuclear yield. The experiment area of such a facility will include many systems and structures that will have to operate successfully in the difficult environment created by the sudden large energy release. This paper estimates many of the nuclear effects that will occur, discusses the implied design issues and suggests possible solutions so that a useful experimental facility can be built.

6423 **Radiation analysis of the CIT pellet injector system and its impact on personnel access.** Selcow, E.C. (Fusion Engineering Design Center/Grumman Corp., PO Box Y, Oak Ridge, TN (USA)); Stevens, P.N.; Gomes, I.C.; Gomes, L.M. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

Conceptual design of the Compact Ignition Tokamak (CIT) is near completion. This short-pulse ignition experiment is planned to follow the operations of the Tokamak Fusion Test Reactor (TFTR) at the Princeton Plasma Physics Laboratory. The high neutron wall loadings, ~4-5 MW/m^2, associated with the operation of this device require that neutronics-related issues be considered in the overall system design. Radiation shielding is required for the production of device components and personnel. A close-in igloo shield has been designed around the periphery of the tokamak structure, and the entire experiment is housed in a circular test cell facility with a radius of ~12m. The most critical radiation concern in the CIT design process relates to the numerous penetrations in the device. This paper discusses the impact of a major penetration on the design and operation of the CIT pellet injection system. The pellet injector is a major component, which has a line-of-sight penetration through the igloo and test cell wall. All current options for maintenance of the injector require personnel access. A nuclear analysis has been performed to determine the feasibility of hands-on access. Results indicate that personnel access to the pellet injector glovebox is possible.

6424 **2DBTOR: A Toroidal diffusion code. .** Hrabal, C.A. (Nuclear Engineering Dept., Texas A and M Univ., College Station, TX (USA)); Parish, T.A. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

Pomraning and Stevens have shown that for an axisymmetric toroidal geometry problem, the diffusion equation can be cast into the identical form of the r-θ cylindrical diffusion equation by a spatially-dependent redefinition of the diffusion coefficient, absorption cross section, and extraneous source function. This paper describes 2DBTOR produced by programming the appropriate variable transformations into a version of the 2DB code[2] that executes on an IBM-AT.

6425 **Capacitor analysis for RF antennas.** Power, W.H. (Martin Marietta Energy Systems, Inc., PO Box Y, Oak Ridge, TN (USA)); Baity, F.W.; Hoffman, D.J. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

Commercially available vacuum capacitors have been used in radio frequency (rf) antenna designs. The dimensional envelope of the capacitors has adapted favorably to antenna concepts. However, capacitors that are commercially available have not demonstrated acceptable performance characteristics for maximum design currents of 800 A rms at 80 MHz and 1300 A rms at 30 MHz or for voltages of 50 kV peak. The reason for capacitor failure was investigated. The investigation consisted of establishing existing mechanical design features, defining desired operating criteria of key capacitor components, determining component design limitations, and developing a modified concept for testing. Effects of capacitor cooling by means of radiative transfer and forced convective transfer were considered. The resulting modified capacitor design concept uses as many components of the commercially available capacitors as possible.

6426 **Fault analysis of the DIII-D neutral beam safety interlock system.** Phillips, J.C. (GA Technologies Inc., PO Box 85608, San Diego, CA (USA)); Colleraine, A.P.; Haskovec, J.S.; Hong, R.; Kim, J.; Sleaford, B.W.; Tooker, J.F.; Wright, J.J. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The DIII-D neutral beam injection systems (NBIS) rely on a substantial array of control and instrumentation for routine operation. Functions include shot sequencing, power supply control, vacuum control, and valve control, along with interlocks for safeguarding personnel and equipment. Failures resulting from improper operation of the neutral beamlines, their power supplies, and supporting services have the potential to cause extensive damage to personnel, equipment, and beamline components, as well as delay of the experimental schedule. This paper addresses equipment and component failures. Intelligence and control are distributed over dissimilar types of equipment in separate locations. An analysis is made of the possible failure modes of the subsystems and the interlocking of systems and operations. This has helped to improve the design of the safety interlock system and to minimize the risk of the NBIS project. The analysis technique is presented and possible outcomes of typical failure modes are explored.

6427 **Beam transmission properties in the DIII-D neutral beamlines.** Wight, J.J. (GA Technologies Inc., PO Box 85608, San Diego, CA (USA)); Colleraine, A.P.; Hong, R.; Kim, J.; Phillips, J.C.; Sleaford, B.W. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

Neutral beam transmission properties in DIII-D beamlines have been investigated by waterflow calorimetry measurements. Recent waterflow calorimetry measurements under long pulse beam operations have revealed a fairly high variation among the eight beams, with the transmission efficiency to the calorimeter ranging from 69% to 78%. A hydrogen injected power of 1.6 MW has been obtained from the best ion source.

6428 **Evolution of the common long pulse neutral beam source program.** Lindquist, W.B. (Lawrence Livermore National Lab. (USA)); Staten, S.H. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract W-7405-ENG-48. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

A common, long pulse, positive ion, neutral beam source was developed, industrialized, and delivered for use on TFTR at PPPL (Princeton Plasma Phsyics Laboratory) and on Doublet III-D at GAT (General Atomics Technologies, Inc.). This paper discusses the evolution of the 10 year program. Topics covered include: the positive ion source development programs at ORNL (Oak Ridge National Laboratory), and at LBL (Lawrence Berkeley Laboratory) user requirements, source selection, common source design, technology, methodology, technology transfer, industrialization, performance, cost, schedule, and lessons learned.

6429 **Operational experience with the DIII-D neutral beam 12 cm x 48 cm common long pulse source.** Hong, R. (GA Technologies Inc., PO Box 85608, San Diego, CA (USA)); Colleraine, A.P.; Haskovec, J.S.; Kellman, D.; Jim, J.; Nerem, A.; Phillips, J.C.; Sleaford, B.; Wight, J.J.; Vella, M.C. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

All four neutral beamline of the DIII-D tokamak have been converted to long pulse source operation. These common long pulse sources (CLPS) were designed for full power operation at 80 kV, 80 A, 5 sec with hydrogen. The CLPS plasma generator is equipped with cusp magnets and operates in the emission limited regime.

The accelerator has an actively cooled tetrode geometry with a 10 m focus in one direction. Each new CLPS requires conditioning of the arc chamber prior to any attempt at beam extraction. It was found that the filament temperature plays an important role in the performance of the arc chamber, and that the arc operated more smoothly with the arc power supply in an unregulated mode and the filament supply in a constant voltage mode. To avoid the collapse of the voltage between the plasma and gradient grids at initial beam formation, a capacitive compensation network between the grids was added. Initial beam extraction typically started at 40 κV and progressed quickly to the full 80 κV capability with little to no degradation during shutdown periods.

6430 Tokamak fringing magnetic fields and magnetic shielding inside the TFTR neutral beam injection boxes. Grisham, L.R. (Princeton Plasma Physics Lab., Princeton Univ., PO Box 451, Princeton, NJ (USA)); Kamperschroer, J.H.; Wright, K.E. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The beamlines which form the neutral injection heating system for the Tokamak Fusion Test Reactor (TFTR) reside in the fringing magnetic fields associated with tokamak operation. Unless shielded out, these fields can deflect the beam ions and, in the process, redistribute the concomitant thermal load to various beamline components, and cause divergence growth and mis-steering in the resulting neutral beam. The authors have carried out measurement ts of the magnetic fields at various locations in a beam line box during tokamak operation. This paper gives the results of these measurements, as well as approximate calculations of the attendant deflections. As a consequence of these measurements additional shielding, which is discussed, has been added in two regions.

6431 Plasma current drive with 1- to 3-MeV neutral beams: An efficient, reactor-relevant approach. . Becraft, W.R. (Oak Ridge National Lab., PO Box Y, Oak Ridge, TN (USA)); Whealton, J.H.; Akerman, M.A.; McMichael, G.E.; Murphy, B.D.; Ryan, P.M.; Haselton, H.H.; Stirling, W.L. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract AC05-84OR21400. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The expanding worldwide research to achieve the required plasma current drive is focusing on neutral beams as the most promising concept for the next generation of ignition devices. Two aspects of the use of neutral beams for creating the plasma current that support the potential selection of this technique for reactors are the relative credibility of beams for driving current that derives from experimental evidence and the ability of beams to penetrate to the plasma center and drive a core current. Continuing considerations of the required currents and current profiles by fusion theorists are identifying the likely need for two mechanisms or knobs for current drive. One knob would control core current drive, and the other would control edge current drive. The ongoing analyses of computational and experimental results are evolving to the selection of high-energy (1- to 3-MeV) neutral beams for core current drive and lower hybrid (LH) wave energy for edge (lower plasma density) current drive. Such a scenario is represented.

6432 Operation of the TFTR heating neutral beam injection system using long pulse ion sources. Stevenson, T. (Princeton Plasma Physics Lab., Princeton Univ., PO Box 451, Princeton, NJ (USA)); Gammel, G.M.; Grisham, L.R.; Kamperschroer, J.H.; Von-Halle, A.; Williams, M.D. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract AC02-76CH03073. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The Long Pulse Ion Sources (LPIS) developed by Lawrence Berkeley Laboratory have been incorporated into the TFTR Heating Neutral Beam Injection System. As a result of the testing done at LBL and additional testing on the TFTR NB Test Stand at PPPL, start-up and operating methods were developed and implemented on the Heating NB Injection System. These methods successfully established high power injection into TFTR plasma. This paper discusses the start-up and conditioning methods required for LPIS operation, Neutral Beam System Operation for conditioning and injection, and Neutral Beam Operation problems and benefits which have resulted from upgrading to the LPIS.

6433 TFTR neutral beam long pulse ion source quality control. Wright, K.E. (Princeton Univ., Princeton Plasma Physics Lab., PO Box 451, Princeton, NJ (USA)); Sloyer, W.S. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract AC02-76CH03073. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

New ion sources with increased operational parameters have been installed and operated on the TFTR Neutral Beam Injection System. The installation of this new equipment involved fabrication, assembly and test of new designs. Procedures were developed to ensure proper assembly and implementation of the new hardware and subsystems. Substantial loss of experimental test time results from any ion source equipment failure(s). Therefore, stringent controls were placed on the preoperational assembly and testing of the Long Pulse Ion Source Assemblies. The failures and difficulties encountered are presented, along with the probable causes and the improvements/modifications implemented to alleviate them.

6434 The microwave Tokamak experiment (MTX). Thomassen, K.I. (Lawrence Livermore National Lab., PO Box 5511, Livermore, CA (USA)); Cohen, B.I.; Hooper, E.B.; Lang, D.D.; Nevins, W.M. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract W-7405-ENG-36. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

A new experimental facility is being assembled at the Lawrence Livermore National Laboratory (LLNL) for studying microwave propagation and absorption in high density plasmas. A unique feature of the facility is the free electron laser (FEL) used to generate high peak power microwaves at 250 GHz, at a repetition rate so as to produce up to 2 MW of average power for up to 30 s. Called the Microwave Tokamak Experiment (MTX), the facility will be used for studies of plasma heating, current drive, and confinement.

6435 Extra high power operation for ICRF tetrode power amplifiers. Grotz, G. (Princeton Plasma Physics Lab., Princeton Univ., PO Box 451, Princeton, NJ (USA)). vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract AC02-76CH03073. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

Nearly 25% additional power over that obtainable with conventional operation can be obtained from a high power gridded tetrode amplifier tube, without exceeding its ratings, through the use of a novel circuit and unusual operation conditions. Consequently, the total equipment cost per watt of output power will be significantly reduced. A further advantage is some protection of the screen grid when working into a mismatched load. The penalty is a 3.5 dB loss in gain to obtain the additional output power over that obtained under conventional conditions. The circuitry is described and the performance of the conventional cathode driven grounded grid amplifier is compared with the unconventional grounded screen grid amplifier through the use of a computer program that simulates the operation of the tube in its circuit utilizing actual component values. The modeling technique is described.

6436 The design of an isotope separation system for JET. Sherman, R.H. (Tritium Science and Technology, Los Alamos National Lab., Los Alamos, NM (USA)). vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

Cryogenic distillation is planned as one of the processes to be used for isotope separation at JET. Three possible configurations of columns for this service are presented and discussed. The ability to easily control a system of columns must weigh heavily in the final selection of a process for construction.

6437 Tritium removal from inert gases using Zr_2Fe. Kherani, N.P. (Los Alamos National Lab., Tritium Systems Test Assembly,

Los Alamos, NM (USA)); Shmayda, W.T.; Jalbert, R.A. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

Tritium handling invariably requires multiple containment to ensure personnel safety and to control emissions to the environment. For this measure to be effective, tritiated environments require periodic or continuous tritium removal. Presently this is achieved by oxidizing tritium bearing compounds followed by adsorption of tritiated water on molecular sieves. An experimental program was initiated to examine the potential of a metal getter detritiation process. In particular the tritium removal characteristics of a zirconium-alloy, Zr_2Fe, were studied.

6438 Overview of tritium systems for the compact ignition Tokamak. Bartlit, J.R. (Tritium Science and Technology Group, Materials Science and Technology Div., Los Alamos National Lab., Los Alamos, NM (USA)); Gruetzmacher, K.M.; Fleming, R.B. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The Compact Ignition Tokamak (CIT) is being designed at several laboratories to produce and study fully ignited plasma discharges. The tritium systems which will be needed for CIT include fueling systems and radiation monitoring and safety systems. Design of the tritium systems is the responsibility of the Tritium Systems Test Assembly (TSTA) at Los Alamos National Laboratory. Major new tritium systems for CIT include a pellet injector, an air detritiation system and a glovebox atmosphere detritiation system. The pellet injector is being developed at Oak Ridge National Laboratory.

6439 Fueling system design for the TIBER II ETR reactor. Gorker, G.E. (Fusion Engineering Design Center, Grumman Corp. (USA)); Haines, J.R.; Nelson, W.D. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The TIBER II tokamak is a design concept for a next generation Engineering Test Reactor (ETR). Deep plasma fueling in the power range is a key feature of this rector design. Deep fueling serves to control the power distribution profile and to increase the plasma current through a phenomenon known as boot strap current. In addition to fueling of the plasma during the steady-state power range operation, fueling is also needed during the start-up and intermediate operating ranges. This paper describes some of the design requirements, reference design feature, and technology development that may be needed for an integrated fueling system.

6440 TMX-U ECRH system operations summary. Heefner, J.W. (Lawrence Livermore National Lab., PO Box 808, L-635, Livermore, CA (USA)); Brooksby, C.A.; Lauze, R.R.; Karsner, P.G. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract W-7405-ENG-48. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The TMX-U ECRH System underwent many extensive changes during the last two years of physics operations. These changes included extensive use of fiber optics and computer control to add extensive use of fiber optics and computer control to add flexibility to the system and eliminate noise problems, upgrades to Varian Model VGA-8050M long pulse gyrotron tubes, the addition of gyrotron anode-modulation for better control of individual gyrotrons, and the installation of a fifth gyrotron socket that was used to simultaneously heat both the east and west inner 10 KG locations. This paper discusses the different modifications made to the system and their effects on the overall performance of the entire ECRH system. The paper also discusses the system as it presently exists and possible modifications that would be made if the future modifications were to be performed.

6441 A d.c. sheet plasma for extraction of H^- and D^-. Lietzke, A.F. (Lawrence Berkeley Lab., Univ. of California, Berkeley, CA (USA)); Guethlein, G. vp of Proceedings of the 12th symposium on fusion engineering. IEEE Service Center, Piscataway, NJ (1987). DOE Contract AC03-76SF00098. (CONF-871007–: 12. symposium on fusion engineering, Monterey, CA (USA), 12-16 Oct 1987).

The authors are testing operation and H^- yield of a sheet plasma source having a narrow primary electron channel (11cm high, 30cm long, and <1cm wide). The design goal was $J_H$sup -//- 30 mA/cm^2 at V_{arc}=100V, I_{arc}=200A, B<200g, and pg=5m1. This is similar in geometry and operational parameters to the plasma reported by Uramoto. Conditions outside the sheet are favorable for H^- production; at pg=10mT (cold fill - 8 sccm). V_{arc}=75V, I_{arc}=125A, and B=200 g, 1 cm from the sheet edge, J^+=380 mA/cm^2, T_e-1.4 eV, and n_e=5 . 10^{12}/cm^3, determined from Langmuir probe measurements. The movable negative ion extractor has a circular source aperature of area 1cm^2. $J_H$sup -//is measured calorimetrically as well as electrically. Agreement of these two signals confirms the effectiveness of the carbon electron dump. Initial extraction at the above conditions produced $J_H$sup -//=7 mA/cm^2 at 2cm from the sheet edge. This current density is far below the design goals as well as below that reported by Uramoto. The authors conclude that the sheet geometry is not primarily responsible for the high yield of $J_H$sup -//in Uramoto's source.

6442 Emittance growth caused by bends in the Los Alamos free-electron laser energy recovery experiment. Carlsten, B.E. (Los Alamos National Lab., Los Alamos, NM). pp. 2030 of Proceedings of the 1987 IEEE particle accelerator conference: Accelerator engineering and technology. Lindstrom, E.R.; Taylor, L.S IEEE Service Center, Piscataway, NJ (1987). (CONF-870302–: Particle accelerator conference, Washington, DC (USA), 16-19 Mar 1987).

Experimentally transporting the beam from the wiggler to the decelerators in the energy recovery experiment (ERX) at the Los Alamos National Laboratory free-electron laser was more difficult than expected because of the large inertial emittance in the beam. This emittance was apparently caused in an early 60^0 achromatic bend. To get this beam through subsequent bends without wall interception, the quadrupole focusing had to be changed from the design amount; as a result, the emittance grew further. This paper discusses various mechanisms for this emittance growth in the 60^0 bend, including effects caused by path changes in the bend resulting from wake-field-induced energy changes of particles in the beam and examines emittance filters, ranging from a simple aperture near a beam crossover to more complicated telescope schemes designed to regain the original emittance before the 60^0 bend.

6443 Thermal management of magnetic focussing horns used in the narrow and broad band neutrino beams at the AGS. Leonhardt, W. (AGS Dept., Brookhaven National Lab., Upton, NY); Carroll, A.; Monaghan, R.; Pearson, C.; Pendzick, A.; Ryan, G.; Sandberg, J.; Sims, W.; Smith, G.; Stillman, P. pp. 2030 of Proceedings of the 1987 IEEE particle accelerator conference: Accelerator engineering and technology. Lindstrom, E.R.; Taylor, L.S IEEE Service Center, Piscataway, NJ (1987). (CONF-870302–: Particle accelerator conference, Washington, DC (USA), 16-19 Mar 1987).

Operation of the AGS Neutrino Horns and their internal and external targets takes place in an environment of high voltage, severe shock and vibration, and high radiation. To insure reliable operation, energy from Joulean heating and the proton beam interaction must be dissipated to keep component temperatures at the lowest levels practical. This has been accomplished by carefully choosing component materials and providing dedicated air and water cooling systems to transfer the 6 kW of heat efficiently and safely to the environment. This paper describes how the rigid horn and target thermal design constraints were satisfied, and provides some record of the current operating experience.

6444 Upper limits on neutron and γ-ray emission from cold fusion. Gai, M. (Yale Univ., New Haven, CT (USA). Wright Nuclear Structure Lab.); Rugari, S.L.; France, R.H.; Lund, B.J.; Zhao, Z.; Davenport, A.J.; Isaacs, H.S.; Lynn, K.G. *Nature (London) (UK)*, 340(6228): 29-34 (6 Jul 1989).

Neutron and γ-ray emission from a variety of electrochemical cells (running continuously for up to two weeks) have been measured using a sensitive detection system with a very low background. Titanium alloy powder deuterided at room temperature and high pressure was also used for comparison. No statistically significant deviation from the background was observed in either γ-ray or neutron detectors. The estimated neutron flux in this experiment is

at least a factor of 50 times smaller than that reported and about one million times smaller than that found by others. The results suggest that a significant fraction of the observed neutron events are associated with cosmic rays. (author).

6445 Can solid-state effects enhance the cold-fusion rate?. Leggett, A.J. (Illinois Univ., Urbana, IL (USA). Dept. of Physics); Baym, G. *Nature (London) (UK),* 340(6228): 45-46 (6 Jul 1989).

Recently two groups have reported finding experimental evidence for an unexpectedly high rate of nuclear fusion at room temperature during the process of electrolytic deposition of deuterium on palladium and titanium. To achieve the rate of neutron production ($\sim 10^{-23} s^{-1}$ per deuteron pair) requires the solid-state environment to produce either an unusual enhancement of the fusion reaction rate or a large suppression of the Coulomb barrier between deuterons. The latter would presumably arise from some kind of sophisticated many-body screening effect in Pd or Ti, perhaps associated with quasiparticles of large effective mass[2]. Here we point out that within the framework of the lowest-order Born-Oppenheimer approximation, a very severe constraint is imposed on all such screening mechanisms in solids in equilibrium by the observable binding affinity of ^{4}He atoms for the metal in question. Unless the latter is quite anomalous, the Coulomb barrier penetration in a solid in equilibrium cannot be enhanced anywhere near the magnitude required to explain the fusion rates inferred from the experiments. (author).

6446 Problems with the γ-ray spectrum in the Fleischmann et al. experiments. Petrasso, R.D. (Massachusetts Inst. of Tech., Cambridge, MA (USA). Plasma Fusion Center); Chen, X.; Wenzel, K.W.; Parker, R.R.; Li, C.K.; Fiore, C. *Nature (London) (UK),* 339(6221): 183-185 (18 May 1989).

The results of recent work claiming to have observed cold fusion are disputed by the authors on the basis of three quantitative factors. The claim that neutron capture by hydrogen nuclei was observed for the 2.22MeV γ-ray line is refuted because the linewidth is too small, a a clearly defined Compton edge at 1.99MeV should be observed but is not mentioned and lastly the neutron production rate is a factor of fifty too large. The features claimed as cold-fusion are postulated by the authors to be related to instrumental effects. (UK).

6447 Criteria for the assessment of fusion power. Sweet, Colin. *Energy Policy (UK),* 17(4): 413-419 (Aug 1989).

Fusion power requires an exceptionally long development time and its future depends on the changing perspectives society uses to evaluate resources in the long term. For 40 years fusion technology developed within a decision making context dominated by technical-political interests, and characterized by a bias towards overoptimism about the future. That is now changing. This article contends that we are still a long way from making rational assessments of large technological projects. However, feasibility for fusion will have to be tested by social criteria at least as important as those used for scientific feasibility. (author).

6448 Is fusion feasible? An assessment of the methodology and policy implications. Jackson, Timothy (Earth Resources Research, London (UK)). *Energy Policy (UK),* 17(4): 407-412 (Aug 1989).

The scientific feasibility of producing electrical power from a thermonuclear reaction in a magnetically confined plasma has yet to be demonstrated. Until it is demonstrated, the acceptability of fusion in social, economic, and environmental terms cannot be demonstrated either. This paper describes and examines the criteria currently advanced for the assessment of the scientific feasibility of the European fusion programme, and concludes that they may not be adequate to the task. Decision making in such an environment is fraught with risk. (author).

6449 Cold fusion doubts and controls. Irvine, J.M. (Manchester Univ. (UK). Schuster Lab.); Riley, S.; Cranberg, L. *Nature (London) (UK),* 339(6225): 515 (15 Jun 1989).

Letter to the Editor.

99 GENERAL AND MISCELLANEOUS

6450 (AERE-PR/TP-45) **Theoretical Physics Division progress report. October 1987 - September 1988.** UKAEA Harwell Lab. (UK). Theoretical Physics Div. Jan 1989. 110p. Order Number DE90608888. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The research areas covered in this report are solid state and quantum physics, theoretical metallurgy, fuel modelling and reactor materials, statistical physics and the theory of fluids. Attention is drawn to a number of items: (i) the application of theories of aerosol behaviour to the interpretation of conditions in the cover-gas space of a fast reactor; (ii) studies in non-linear dynamics, dynamical instabilities and chaotic behaviour covering for example, fluid behaviour in Taylor-Couette experiments, non-linear behaviour in electronic circuits and reaction-diffusion systems; (iii) the development of finite element computational techniques to describe the periodic behaviour of a system after a Hopf bifurcation and in simulating solidification processes; (iv) safety assessment of disposal concepts for low- and intermediate-level radioactive wastes. (U.K.).

6451 (CONF-8911112-1) **Advanced designs and improved operating procedures for the Eglin Air Force Base depleted uranium firing facility.** Bradshaw, W.M.; Wichner, R.P.; Williams, H. Oak Ridge National Lab., TN (USA). [1989]. 15p. Sponsored by U.S. Department of Defense. DOE Contract AC05-84OR21400. From 14. annual Army environmental R and D symposium; Williamsburg, VA (USA); 14-16 Nov 1989. Order Number DE90002481. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Armor-penetrating projectiles fabricated from depleted uranium (DU) are routinely test fired at Eglin Air Force Base (AFB) as part of the ammunition surveillance program. The catchment facility for the projectiles consists of a large sand butt in a reinforced concrete building that contains all spent DU rounds and DU-contaminated byproducts. The sand is screened periodically to remove DU projectiles and other oversized materials. Complete sand replacement is required after three firing/sifting cycles to reduce the quantity of fine material in the butt. The current system is effective, but disposal of the uranium-contaminated sand is very costly. This paper describes equally effective but less costly systems that can be generally grouped as (1) alternate catchment media and catchment design, (2) sand/DU separation, and (3) improved operations using the current facility. A detailed economic model was developed to compare systems involving sand/DU separation, sand reuse and changes in operating procedures.

6452 (CONF-8911116-1) **US mobilizations in the twentieth century: Implications for the future.** Horwich, G. (Purdue Univ., Lafayette, IN (USA)). Oak Ridge National Lab., TN (USA). Oct 1989. 41p. Sponsored by U.S. Federal Emergency Management Agency. DOE Contract AC05-84OR21400. From APPAM conference; Washington, DC (USA); 1-4 Nov 1989. Order Number DE90002467. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Four US mobilizations in the twentieth century are compared in terms of several broad macroeconomic variables and assessed in terms of policy initiatives that preceded them. World War I was the least effective in delivering war material to US troops. World War 2, the only "total" mobilization, was highly effective, though it proceeded over a four or five-year period. The buildup of the Korean War, a more limited engagement, moved with relative speed. The Vietnam mobilization was essentially a minor increment to the pre-war level of defense spending. Manpower sources in all four wars are also identified. Mobilization strategies have undergone frequent modification and were not always adequate to the mobilizations they served. 3 refs., 18 tabs.

6453 (INIS-mf-11556) **AEC review 1988.** Atomic Energy Corp. of South Africa (Pty) Ltd., Pretoria (South Africa). Oct 1988. 37p. Order Number DE90608902. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This report is also available in Afrikaans as AEK Oorsig 1988.

Activities of the Atomic Energy Corporation of South Africa Limited (AEC) are reviewed. The activities of each of the six Management Units, namely Uranium Processing, Uranium Enrichment, Research and Development, Engineering, Human Resources and

Finance and Commercial Affairs, are discussed. The Uranium Processing Unit includes the two major production programmes, viz. UF6 production and fuel-element fabrication. The objective of the Uranium Enrichment Management Unit is the supply of enriched uranium. The unit operates two uranium enrichment plants, the semicommercial Z Plant and the pilot plant. The Research and Developement Unit is structured into 7 programmes which are related mainly to the fuel cycle. It concentrates on facets of the nuclear fuel cycle, by-products of the nuclear industry and research services, as well as transfer of specialized technology to private industry. The Engineering Unit includes Engineering Services, Technical Services, Nuclear Waste Technology which involves the handling and disposal of all radioactive waste in South Africa, Central Quality Services, and Safety. The Human Resources Management Unit is divided in four functional units, viz. Manpower Services, Labour Relations, Training and Development and Manpower Specialized Services. The Unit Finance and Commercial Affairs consists of Financial and Accounting Services, Management Services, Corporate Information and Marketing and Commercial Services. A list of products and services delivered by the AEC is included as well as a list of publications by staff members.

6454 (INIS-mf–11559) **Annual report 1987-88.** Department of Atomic Energy, Bombay (India). 1988. 121p. Order Number DE90608903. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The annual report of the Department of Atomic Energy (India) for the financial year 1987-88 describes: (1) Research and Development (R and D) activities of its research establishments, namely, the Bhabha Atomic Research Centre, Bombay; the Indira Gandhi Centre for Atomic Research, Kalpakkam and the Centre for Advanced Technology, Indore; and of almost fully funded research institutions, namely, the Tata Institute of Fundamental Research, Bombay; Tata Memorial Centre, Bombay; Saha Institute of Nuclear Physics, Calcutta; and Institute of Physics, Bhubaneshwar; (2) performance of nuclear power stations at Tarapur, Rawatbhata and Kalpakkam, various heavy water plants around the country, the Nuclear Fuel Complex, Hyderabad, fuel reprocessing plants, (3) exploration work for atomic minerals, (4) regulatory and safety functions, (5) performance of public sector undertakings, namely, Indian Rare Earths Ltd., Electronics Corporation of India Ltd., and Uranium Corporation of India Ltd., (6) other activities including international relations, financial assistance to research schemes in science and engineering etc. During the year, the Nuclear Power Board was converted into Nuclear Power Corporation (NPC) of India Ltd. with the objectives of managing the nuclear power stations on commercial lines and raising finance from the public for its projects. The Board of Radiation and Isotope Technology (BRIT) was set up to promote radiation technology on a commercial basis in the country. (M.G.B.). Coloured pictures.

6455 (PNL-SA–17239) **Engineering career: A lifetime of transitions.** Mayer, R.J. Pacific Northwest Lab., Richland, WA (USA). Nov 1989. 4p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-891198–2: 6. IEEE careers conference: engineering and engineering managers: challenges of the 90's, St. Petersburg, FL (USA), 1-3 Nov 1989). Order Number DE90002731. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

People in general and engineers in particular are poorly prepared for the transitions they are likely to face during their careers. The awareness of some fairly simple truths could help many engineers manage their careers more effectively. I will only mention some of these truths. I urge you to explore and evaluate them for yourself; merely taking my word is of limited value. We are searching for ahas! Mere intellectual understanding of these matters rarely translates into meaningful action.

6456 (VTT-EKA-B–6) **Nuclear energy related research. Research programme plan 1989.** Salminen, Pertti (comp.). Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Mar 1989. 63p. Order Number DE90608894. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

This annual Research Programme Plan covers the publicly funded nuclear energy related research planned to be carried out at the Technical Research Centre of Finland (VTT) in 1989. The research will be financed by the Ministry of Trade and Industry, the Finnish Centre for Radiation and Nuclear Safety, the Nordic Council of Ministers and VTT itself.

9901 Management

Refer also to citation(s) 5321, 5741, 5965

6457 (DOE/IG–0010/6) **Annual work plan for FY 1990.** USDOE Office of Inspector General, Washington, DC (USA). 30 Sep 1989. 68p. Sponsored by U.S. DOE Management & Administration. Available from OSTI.

The Office of Inspector General (OIG) has an overall mission to prevent and detect fraud, waste, and mismanagement in Department of Energy (DOE) programs. As part of its responsibility in accomplishing its mission, the DOE Office of Audits publishes an "Annual Work Plan" in September of each year. The prime focus of the plan is to identify opportunities for audits to enhance the effectiveness, efficiency, and integrity of the DOE's programs and operations. Through this plan, we are able to maximize the effectiveness of our resources and to avoid duplicating audit coverage being provided by other audit groups, such as the US General Accounting Office (GAO) to US Department of Energy programs. Such planning is required by Office of Management and Budget Circular A-73 and DOE Order 2321.1. This work plan, in an effort to more realistically plan the year ahead, moves away from the traditional listing of all audits to be undertaken for the year. Only those audits that are to be carried over from the previous fiscal year and those that are to be started in the first quarter of the new fiscal year will be listed. The balance of time available has been allocated to the major program areas for FY 1990, and new audits will be identified and started during the year based on the knowledge gained from completed or in-process audits. This process represents the beginning of our use of long-term multi-year program strategies.

6458 (DOE/IG–0270) **Management and operating contractors' support services at McCarran International Airport, Las Vegas, Nevada.** USDOE Office of Inspector General, Washington, DC (USA). 9 Aug 1989. 15p. Sponsored by U.S. DOE Office of Inspector General. Available from OSTI.

This audit evaluated the Department of Energy's (Department) oversight of Lawrence Livermore, Los Alamos, and Sandia National Laboratories' need for support services at McCarran International Airport (McCarran), Las Vegas, Nevada. An examination followed generally accepted Government auditing standards for performance audits, included tests of internal controls, and compliance with laws and regulations necessary to satisfy the audits objective. Since this review was limited, it would not necessarily disclose all material internal control weaknesses. However, the finding relating to duplicate services and a lack of annual real property surveys showed internal control weaknesses. These should be considered when preparing the year-end assurance memorandum on internal control deficiencies.

6459 (EUR–11524) **Nuclear measurements and reference materials Programme progress report, January - December 1987.** Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements. 1988. 98p. Available from NTIS (US Sales Only), PC A05/MF A01.

This report summarizes the progress of the JRC programs on nuclear data, nuclear metrology, nuclear reference materials and non-nuclear reference materials. Budget restrictions and personnel difficulties were encountered during 1987. Fission properties of ^{235}U as a function of neutron energy and of the resonances can be successfully described on the basis of a three exit channel fission model. Double differential neutron emission cross-sections were accomplished on ^{7}Li and were started for the tritium production cross-section of ^{9}Be. Reference materials of uranium minerals and ores were prepared. Special nuclear targets were prepared. A batch of 250 g of $Pu0_2$ was characterized in view of certification as reference material for the elemental assay of plutonium.

6460 (IAEA-TECDOC–531) **International Centre for Theoretical Physics, Trieste: Scientific activities in 1988.** International Atomic Energy Agency, Vienna (Austria). Oct 1989. 107p. Order

Number DE90610395. Available from NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS.

The document contains three parts. Part I is a review of the Scientific activities in 1988 with a statistical digest. Part II describes the scientific programme in Fundamental physics, Condensed matter, Atomic and molecular physics, Mathematics, Physics and energy, Physics and environment, Physics of the living state, Applied physics, Adriatico research conferences. Part III lists the publications issued in 1988. Tabs.

6461 (IC–89/265) **Dirac - The taciturn genius.** Kamran, M. International Centre for Theoretical Physics, Trieste (Italy). Aug 1989. 33p. Order Number DE90610986. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The contributions of P.A.M. Dirac to the quantum mechanics, quantum field theory and to the theory of elementary particles are presented. Refs.

6462 (IEN-DERE-DIMEC–002/89) **POS2D: user manual.** Cruz, J.R.B.; Araujo, U.P. de. Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil). Div. de Mecanica Estrutural. 24 Feb 1989. 26p. (In Portuguese). Order Number DE90608890. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

A user manual for POS2D computer program is presented. This program is used to drawn graphics of structural analysis.

6463 (INIS-mf–11541) **RCA annual report 1988.** International Atomic Energy Agency, Vienna (Austria). Sep 1989. vp Order Number DE90608901. Available from NTIS (US Sales Only), PC A01/MF A01 - OSTI; INIS.

The report covers the calendar year 1988. It contains an extended preface on Asian regional co-operation in the application of nuclear techniques, a summary of major RCA meetings, administrative questions, a summary of technical aspects of the programme and an analysis of the resources including a prediction of project activities for 1989-1991. 4 figs, 3 tabs.

6464 (NEI-NO–99) **SIS 50 years: 1939 - 1989.** Statens Inst. for Straalehygiene, Oslo (Norway). 1989. 87p. (In Norwegian). Order Number DE90610987. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

In 1938 the Norwegian Parliament passed a law to ensure protection against ionizing radiation. The law stated that all use of ionizing radiation should be under governmental supervision. To enact this supervision, the National Institute for Radiation Hygiene was established in 1939. This booklet gives a historical review of the institute's development, which to a great extent reflects the general development of radiation protection in Norway.

6465 (NKS–88-3) **Nordic projects in the field of nuclear safety. Annual report 1987.** Soerensen, H.C. (ed.). Nordisk Kontaktorgan for Atomenergispoergsmaal, Risoe (Denmark). May 1988. 39p. (In Danish, Norwegian, Swedish Order Number DE90610415. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This report deseribes the work in 1987 within the Nordic program concerning nuclear safety 1985-1989. The report has the form of a handbook meant for those in Scandinavia who are involved in nuclear safety, and it is based on statements from the constituent subject fields of the program. The first chapter is a short summary of the work and results over the year. In the next chapter an account is given of the ongoing projects within each of the subject fields. An economic survey of the entire program and a list of the reports and articles published in 1987 is included in the publication as well. Chapter 5 is a complete list of adresses comprising participants, project managers, program coordinators and members of the advisory group. (SH) 74 refs.

6466 (OUP–89-09) **Section for nuclear physics annual report. January 1 - December 31, 1988.** Oslo Univ. (Norway). Fysisk Inst. Apr 1989. 72p. Order Number DE90610416. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

The experimental activities in nuclear physics have in 1988 mainly been centered around the cyclotron laboratory with the SCANDITRONIX MC-35 cyclotron. The CACTUS multidetector system has been realised and will soon be operating. With 8 particle telescopes, 28 NaI detectors and 2 Ge detectors this experimental arrangement represents a major improvement compared to earlier set-ups in the laboratory. Theoretical studies of many-body problems, nuclear structure and reactions have continued. The study of problems related to the foundations of quantum mechanics has also been persued.

6467 (PNL-SA–15982) **A formula for continued improvement: Audit follow-up.** Maday, J.H. Jr. Pacific Northwest Lab., Richland, WA (USA). Oct 1989. 9p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. (CONF-8910298–1: 1989 Western regional conference of the American Society for Quality Control, Salt Lake City, UT (USA), 26 Oct 1989). Order Number DE90002657. Available from NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.

In his book Management Audits, Allan J. Sayle states, "QA standards stipulate that corrective action, required as a result of performing an audit, be followed up and closed out. There would, indeed, be little point in performing audits, requiring corrective action, or having a QA system at all if the auditee knows that the auditor will never verify that the corrective action has been efficaciously implemented." The QA auditor has an obligation to include follow-up in the overall audit planning. All too often the auditor will go to great lengths to plan and perform an audit only to have a recurring finding in the next audit. The proposed corrective action was only promissory and was not designed to stop the problem from recurring or to identify its root cause. Auditors do a disservice to the overall QA program and particularly to the customer when they fail to follow up and verify that an audit corrective action has been effectively implemented. In this paper, the techniques used by the quality assurance auditors at the Pacific Northwest Laboratory (PNL) will be presented. Although PNL is a research and development laboratory, the techniques outlined in this paper could be applied to any industry conducting quality assurance audits. Most important, they provide a formula for continued improvement by assuring that audit follow-up is timely, meaningful, and permanent.

6468 (RISO-M–2782) **Progress report 1 January - 31 December 1988. Department of Information Technology.** Risoe National Lab., Roskilde (Denmark). Apr 1989. 36p. Order Number DE90610991. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

This progress report describes the work carried out in the Department of Information Technology. The department comprises three sections. The Applied Laser Physics Section works in the areas of holographic optical elements, optical image processing, and the photorefractive effect. The Computer Section is primarily responsible for the central computer facilities and computer networks at Risoe. The Section for Information Processing and Cognitive Science, Sicos, is concerned with cognitive science, decision support, knowledge-based systems, and process simulation. Information given may be preliminary. (author) 1 tab., 9 ills., 46 refs.

6469 (RISO-M–2786) **Annual report 1988 Chemistry Department.** Funck, J.; Neve Larsen, Aa.; Larsen, E.; Nielsen, O.J. (eds.). Risoe National Lab., Roskilde (Denmark). May 1989. 70p. Order Number DE90610993. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

This report contains a brief survey of the main activities in the Chemistry Department. The names and abstracts of all articles and reports published and lectures given in 1988 are presented. The facilities and equipment are mentioned briefly. The activities are divided into the following groups: radioisotope chemistry, analytical- and organic chemistry, environmental chemistry, polymer chemistry, chemical reactivity, mineral processing, and general. (author).

9902 Mathematics and Computers

Refer also to citation(s) 4557, 4638, 4673, 4706, 4788, 4790, 4791, 4794, 4800, 4832, 4835, 4836, 4837, 4842, 4843, 4848, 4850, 4851, 4853, 4879, 4888, 4889, 4950, 4967, 4974, 5021, 5074, 5100, 5103, 5112, 5113, 5115, 5117, 5118, 5119, 5120, 5144, 5150, 5158, 5173, 5175, 5178, 5198, 5199, 5200, 5201, 5202, 5203, 5204, 5205, 5206, 5207, 5208, 5214, 5282, 5300, 5310, 5311, 5312, 5313, 5318, 5325, 5327, 5339, 5342, 5345, 5351, 5369, 5381, 5412, 5446, 5482, 5517, 5526, 5532, 5559, 5624, 5625, 5626, 5632, 5633, 5634, 5635, 5643, 5645, 5649, 5666,

5668, 5669, 5670, 5694, 5710, 5718, 5770, 5785, 5799, 5800, 5801, 5809, 5824, 5908, 5915, 6016, 6048, 6080, 6099, 6100, 6241, 6356, 6358, 6372, 6376, 6380, 6397, 6420, 6424, 6440

6470 (ANL/TM–431-Rev.2) **Electronic mail at ANL: Revision 2.** Larson, E.M.; Rutkowski, J.L. (eds.); Finkel, B.S.; Andre, M.S. Argonne National Lab., IL (USA). Oct 1989. 180p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. Order Number DE90002631. Available from NTIS, PC A09/MF A01 - OSTI; GPO Dep.

This report discusses concepts, issues, and commands basic to electronic mail and describes the capabilities and limitations of the electronic mail systems currently in place at Argonne National Laboratory, with an emphasis on communication through BITnet. The primary purpose of this document is to complement the detailed information found in vendor documents on electronic mail. You can find the details and procedures of specific electronic mail systems in the appropriate manuals listed in the Bibliography.

6471 (CEA-N–2594) **CEA Benchmark results on a Cray Y-MP/832.** Meurant, G. CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France). Feb 1989. 35p. (In French). Order Number DE90727320. Available from NTIS (US Sales Only), PC A03/MF A01.

In this note, we present the results obtained with the CEA Benchmark on a CRAY Y-MP/832. The performances of the new machine are better than those of a Cray X-MP, specially regarding parallel computation.

6472 (CONF-891251–1) **Robot navigation research at CESAR [Center for Engineering Systems Advanced Research].** Barnett, D.L. (Oak Ridge National Lab., TN (USA)); de Saussure, G.; Pin, F.G.; Sabharwal, A.; Iyengar, S.S. Oak Ridge National Lab., TN (USA). [1989]. 15p. Sponsored by U.S. DOE Energy Research. DOE Contract AC05-84OR21400. From 28. IEEE conference on decision and control; Tampa, FL (USA); 13-15 Dec 1989. Order Number DE90000572. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

A considerable amount of work has been reported on the problem of robot navigation in known static terrains. Algorithms have been proposed and implemented to search for an optimum path to the goal, taking into account the finite size and shape of the robot. Not as much work has been reported on robot navigation in unknown, unstructured, or dynamic environments. A robot navigating in an unknown environment must explore with its sensors, construct an abstract representation of its global environment to plan a path to the goal, and update or revise its plan based on accumulated data obtained and processed in real-time. The core of the navigation program for the CESAR robots is a production system developed on the expert-system-shell CLIPS which runs on an NCUBE hypercube on board the robot. The production system can call on C-compiled navigation procedures. The production rules can read the sensor data and address the robot's effectors. This architecture was found efficient and flexible for the development and testing of the navigation algorithms; however, in order to process intelligently unexpected emergencies, it was found necessary to be able to control the production system through externally generated asynchronous data. This led to the design of a new asynchronous production system, APS, which is now being developed on the robot. This paper will review some of the navigation algorithms developed and tested at CESAR and will discuss the need for the new APS and how it is being integrated into the robot architecture. 18 refs., 3 figs., 1 tab.

6473 (CONF-891251–2) **Gradient projection techniques for large-scale optimization problems.** More, J.J. Argonne National Lab., IL (USA). [1989]. 4p. Sponsored by U.S. DOE Energy Research. DOE Contract W-31109-ENG-38. From 28. IEEE conference on decision and control; Tampa, FL (USA); 13-15 Dec 1989. Order Number DE90001986. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

We briefly describe the impact of the identification properties of the gradient projection method on algorithms for the solution of large-scale optimization problems with bound constraints. In particular, we describe recent results of More and Toraldo which show that the gradient projection method can be combined with the conjugate gradient method to solve an important class of large-scale (number of variables between 5000 and 15000) bound constrained quadratic programming problems with a few (less than 15) iterations. 24 refs.

6474 (IEN-DERE-DIMEC–001/89) **POS2D: a graphic program for analysing axyssimetric and two-dimensional structures.** Cruz, J.R.B.; Araujo, U.P. de. Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil). Div. de Mecanica Estrutural. 12 Jan 1989. 11p. (In Portuguese). Order Number DE90608884. Available from NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS.

The implementation of a computer program for graphic post processing of data related to the structure analysis is presented. This program uses the finite element method.

6475 (KCP–613-4206) **The role of features in the implementation of concurrent product and process design.** Hummel, K.E.; Brown, C.W. Allied-Signal Aerospace Co., Kansas City, MO (USA). Kansas City Div. Oct 1989. 17p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00613. (CONF-891254–1: Symposium on concurrent product and process design, San Francisco, CA (USA), 11-15 Dec 1989). Order Number DE90002966. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

There has recently been much literature written concerning the subject of features in the context of design and manufacturing automation. In particular, features have been hailed as the savior by which the long separated disciplines of design and manufacturing may be reunited. Such prophecy has subsequently elevated the term "features" from a stature of relative insignificance to the distinction of being a bonafide CAD/CAM vernacular. As unfortunately seems to be the case with most technological "buzzwords," however, there has been much confusion concerning the significance of this concept. In particular there has been a general misunderstanding over the role features should play in the achievement of concurrent product and process design. It has been suggested that those features used to design a part should also be used to guide planning for the production of that part. While elegant in its simplicity and certainly feasible for selected cases, this notion tends to ignore the context-dependency of most features and does not generally scale to the real world. This paper argues that while features are integral to the automation of experience-based reasoning in design and manufacturing, their role in the integration of these activities is relatively minor. This argument is made through the use of real-world case studies that illustrate the manufacturing implications of minor variations in feature decompositions. It is further argued that the inevitable consequence of this argument in the context of concurrent product and process design is an intensified need for automatic feature recognition. 21 refs., 11 figs.

6476 (K/DSRD–112-Vol.1) **Case tool evaluation system.** Green, P.L.; Andreae, P.V.; Pennewell, W.J.; Clinard, L.A.; Thomas, B. Jr.; Tarrant, P.M. Oak Ridge National Lab., TN (USA). [1989]. 166p. Sponsored by U.S. Department of Defense; U.S. Department of Justice. DOE Contract AC05-84OR21400. Order Number DE90003698. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

An automated system that uses an analytical approach to evaluate Computer-Aided Software Engineering (CASE) tools is currently being developed. this system is referred to as the CASE Tool Evaluation System. The following general criteria will be used: overall tool functionality; tool stability; cost; interfaces with other software; customization; ease of use; output produced; hardware and operating system needs; documentation; training and vendor support; repository interface; methodologies; and vendor stability. in Phase 1 CASE tools will be eliminated that do not meet certain "must-have" characteristics specified by the user. Phase 2 will further reduce the size of the tool list by retaining those tools that possess "desirable, but not absolutely necessary" characteristics, also specified by the user. Phase 3 will employ the Analytic Hierarchy Process, developed by Dr. Thomas L. Saaty, to rank the tools. Users will be able to supply tools of their own choosing, in addition to tools that are generated via normal use of the system. All three phases will interact with a database that stores objective information about CASE tools. The use of the Analytic Hierarchy process (AHP) distinguishes this method of CASE tool evaluation from others. As used in this system, the AHP is a method of breaking down the complex, unstructured problem of selecting a CASE tool into its component evaluation criteria and candidate tools. These criteria and tools are

arranged into a hierarchical order. Each criterion and tool is assigned a subjective numerical value (by experts or users or both). These values are then synthesized to determine which have the highest priority. The result will be a ranked list of CASE tools tailored to the needs and desires of the user.

6477 (LA–11606-MS) **FRAC-IN-THE-BOX utilization.** Collins, D.G.; West, J.T. Los Alamos National Lab., NM (USA). Jun 1989. 28p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE90003648. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

FRAC-IN-THE-BOX is a computer code developed to calculate the fractions of rectangular parallelepiped mesh cell volumes that are intersected by combinatorial geometry type zones. The geometry description used in the code is a subset of the combinatorial geometry used in SABRINA. The input file may be read into SABRINA and three dimensional plots made of the input geometry. The volume fractions for those portions of the geometry that are too complicated to describe with the geometry routines provided in FRAC-IN-THE-BOX may be calculated in SABRINA and merged with the volume fractions computed for the remainder of the geometry. 21 figs., 1 tab.

6478 (LA–11681-MS) **Uniform versus random sampling in physical calculations: Monte Carlo.** Devaney, J.J. Los Alamos National Lab., NM (USA). Sep 1989. 16p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-36. Order Number DE90003247. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

It is argued that whenever the sampling of the mean physical behavior of a system can be broken up into the successive sampling of a sequence of independent basic probability functions, then a uniform deterministic sampling of each such function for a fixed number of trials is always superior, or at least as good as, uniformly distributed (or probable) random sampling of each such function. Elementary numerical examples are given. A brief discussion is given of the relative merits of uniform deterministic sampling versus uniformly distributed random sampling in practical problems, e.g. the Monte Carlo methods. We conclude that in such problems other advantages of random sampling often overweigh the superior accuracy of uniform deterministic sampling. Thus uniform deterministic sampling should properly be thought of as an addition to present Monte Carlo techniques and not as a replacement. 8 refs., 1 fig.

6479 (LBL–25435) **Optimizing and evaluating algorithms for replicated data concurrency control.** Kumar, A.; Segev, A. Lawrence Berkeley Lab., CA (USA). Feb 1989. 27p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8906250–1: 9. international conference on distributed computing systems, Newport Beach, CA (USA), 5-9 Jun 1989). Order Number DE90003080. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Techniques for optimizing a static voting type algorithm are presented. Our optimization model is based on minimizing communications cost subject to a given availability constraint. We describe a semi-exhaustive algorithm for solving this model. This algorithm utilizes a novel signature-based method for identifying equivalent vote combinations, and also an efficient algorithm for computing availability. Static algorithms naturally have the advantage of simplicity; however, votes and quorum sizes are not allowed to vary. Therefore, the optimized static algorithm was compared against the available copies method, a dynamic algorithm, to understand the relative performance of the two types of algorithms. We found that if realistic reconfiguration times are assumed, then no one type of algorithm is uniformly better. The factors that influence relative performance have been identified. The available copies algorithm does better when the update traffic ratio is small, and the variability in the inter-site communications cost is low. 15 refs., 1 fig., 3 tabs.

6480 (PNL-SA–17603) **Developmental versions of FORTRAN/77 routines for the design and analysis of mixture experiments.** Piepel, G.F.; Linbo-Terhaar, B.M. Pacific Northwest Lab., Richland, WA (USA). Nov 1989. 107p. Sponsored by U.S. DOE Nuclear Energy. DOE Contract AC06-76RL01830. Order Number DE90003513. Available from NTIS, PC A06/MF A01 - OSTI; GPO Dep.

This document contains preliminary, developmental FORTRAN/77 codes that implement several techniques for the statistical design and analysis of mixture experiments. The codes contained herein are as they existed at the end of August 1988 when funding of their development ceased. This paper contains a list of the attached FORTRAN/77 source codes. The documentation for each code is built-in at the beginning of each source code. Descriptions of the code capabilities are given in this built-in documentation. Potential users should use extreme caution because of the preliminary, developmental nature of the codes. Some of the codes were partially tested, while others were not tested at all. All of the codes were still under development and should be treated accordingly.

6481 (SAND–89-8249) **CTSS to UNICOS migration plan.** Sheaffer, K.L. (Sandia National Labs., Livermore, CA (USA)); Porter, T.L.; Jones, H.D.; Jefferson, T.J.; Cody, T.J.; Gomes, D.; Hutchins, J.A.; Derby, D.; Faulkner, T.; Mines, R. Sandia National Labs., Livermore, CA (USA). Nov 1989. 73p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DR00789. Order Number DE90003185. Available from NTIS, PC A04/MF A01 - OSTI; GPO Dep.

This guide is intended to help users migrate from the CTSS Operating System to the UNICOS Operating System on the Cray supercomputers. This guide will also provide introductory information about the UNICOS configuration, migration tools, and compiler differences.

6482 (SOL–89-17) **The parallel decomposition of linear programs.** Entriken, R. Stanford Univ., CA (USA). Dept. of Operations Research. Nov 1989. 167p. Sponsored by U.S. Department of Defense; U.S. DOE Energy Research; National Science Foundation. DOE Contract FG03-87ER25028;FG03-87ER25030. DMS 8913089;DDM-8814253;ECS-8715153;N00014-89-V-1659;N00014-87-K Order Number DE90003538. Available from NTIS, PC A08/MF A01 - OSTI; GPO Dep.

This thesis introduces a new calculus for manipulating linear-program decomposition schemes. A linear program is represented by a communication network, which is decomposed by splitting nodes in two, and a transformation is defined to recover subproblems from the network. We also define a dual-symmetric oracle that provides solutions to linear programs, and can be performed by the simplex method, nested decomposition, and finally, parallel decomposition. Two important classes of linear program serve as examples for the above calculus: staircase linear programs and stochastic linear programs. For the former case, a sophisticated yet experimental computer code has been written for an IBM 3090/600E with six processors. The code performs the parallel decomposition algorithm and is tested on twenty-two small to medium sized "real-world" problems. Experiments show that in addition to speedups provided by decomposition alone, performance is improved by using parallel processors. 57 refs., 33 figs., 14 tabs.

6483 (UCRL–100557) **Knowledge representations for the automatic generation of numerical simulators for PDEs.** Balaban, D. (Lawrence Livermore National Lab., CA (USA)); Garbarini, J.; Greiman, W.; Durst, M. Lawrence Livermore National Lab., CA (USA). 21 Feb 1989. 9p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-891213–1: International Association of Mathematics and Computers Simulation conference, West Lafayette, IN (USA), 5-7 Dec 1989). Order Number DE89008036. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

In this paper we describe an automatic programming (AP) system which generates numerical discretization schemes for partial differential equation (PDE) problems. This system is based on the observation that a wide variety of discretization schemes can be mechanically produced by computing surface integrals of spacetime currents. However, surface integration is difficult to carry out using conventional vector calculus. For this reason, the system is structured to include the differential geometry formalisms which make high dimensional surface integration simple. The differential geometry formalisms have also simplified the representation of continuous physics problems and increased the domain of applicability of the system. 10 refs., 1 fig., 3 tabs.

6484 (UCRL–100671) **A tutorial on software reliability engineering.** Lawrence, J.D. Lawrence Livermore National Lab., CA (USA). 12 May 1989. 21p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-891222–1: Computer Measurement Group annual meeting, Reno, NV (USA), 11-15 Dec 1989). Order Number DE89012368. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

Computer systems are increasingly being required to operate free from externally-detected failures. This is particularly true in the case of large distributed real-time and transaction-processing systems in application areas such as transportation, medicine, defense, finance, marketing and communications. There are many similarities in approaches and techniques between performance analysis and reliability analysis, so the local Performance Expert is a natural person to approach for help with reliability problems. This tutorial will provide an introduction to Reliability Engineering, primarily as it applies to software development. It consists of four parts. The first part defines some important terms, and describes some ways to classify faults and failures. The second portion describes various kinds of activities that can be carried out during the life cycle of the application system, especially those that will be of interest to the Reliability Expert. The fourth section discusses various techniques for achieving software fault tolerance. Finally, we discuss a few modeling techniques and the problems of accurate data collection. 16 refs., 1 fig.

6485 (UCRL–101076-Rev.1) **LLNL's plan for a prototype circuit switch, a potential gigabit LAN of the future.** Rupert, P.R. (Lawrence Livermore National Lab., CA (USA)). Lawrence Livermore National Lab., CA (USA). Oct 1989. 7p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8904210–4-Rev.1: Cray user's group conference, Los Angeles, CA (USA), 24-28 Apr 1989). Order Number DE90003614. Available from NTIS, PC A02/MF A01 - OSTI; GPO Dep.

LLNL's High Speed Communication project will prototype a communications system designed to foster distributed computing and to provide visualization from our supercomputers to our scientists and engineers. High quality graphics images require 24 MBits per frame and 750 MBits/sec for animation; we fully anticipate that the next generation of Supercomputers will provide animated results for general users. Local visualization machines will be available for rendering and graphics manipulation, but visualization of meaningful physics will require communications of large blocks of computed results between Supercomputers and local devices. In addition to visualization, we are developing a distributed computing environment. The required transfer of data between supercomputers and other local mini-supers or special purpose floating point accelerators, will sorely tax our existing communications ability. Improved communications mechanisms will be necessary before distributed applications can become truly effective. This paper describes our plans to demonstrate, through the use of a prototype system, data transmission at 800 MBits/sec per channel and aggregate bandwidth growth that is linear with the number of connected users and computers. 3 figs.

6486 (UCRL–102059) **Simulating the scheduling of parallel supercomputer applications.** Seager, M.K.; Stichnoth, J.M. Lawrence Livermore National Lab., CA (USA). 19 Sep 1989. 30p. Sponsored by U.S. DOE Defense Programs. DOE Contract W-7405-ENG-48. (CONF-8911132–1: Parallelization discussions, Yorktown Heights, NY (USA), 2-3 Nov 1989). Order Number DE90003604. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

An Event Driven Simulator for Evaluating Multiprocessing Scheduling (EDSEMS) disciplines is presented. The simulator is made up of three components: machine model; parallel workload characterization ; and scheduling disciplines for mapping parallel applications (many processes cooperating on the same computation) onto processors. A detailed description of how the simulator is constructed, how to use it and how to interpret the output is also given. Initial results are presented from the simulation of parallel supercomputer workloads using "Dog-Eat-Dog," "Family" and "Gang" scheduling disciplines. These results indicate that Gang scheduling is far better at giving the number of processors that a job requests than Dog-Eat-Dog or Family scheduling. In addition, the system throughput and turnaround time are not adversely affected by this strategy. 10 refs., 8 figs., 1 tab.

6487 **The perfect club benchmarks: Effective performance evaluation of supercomputers.** . Berry, M. (Illinois Univ., Urbana, IL (USA). Center for Supercomputing Research and Development); Chen, D.; Koss, P.; Kuck, D.; Lo, S.; Pang, Y.; Pointer, L.; Roloff, R.; Sameh, A.; Clementi, E. *International Journal of Supercomputer Application (USA)*, 3(3): 5-40 (1989).

This report presents a methodology for measuring the performance of supercomputers. It includes 13 Fortran programs that total over 50,000 lines of source code. They represent applications in several areas of engineering and scientific computing, and in many cases the codes are currently being used by computational research and development groups. The authors also present the PERFECT Fortran standard, a set of guidelines that allow portability to several types of machines. Furthermore, they present some performance measures and a methodology for recording and sharing results among diverse users on different machines. The results presented in this paper should not be used to compare machines, except in a preliminary sense. Rather, they are presented to show how the methodology has been applied, and to encourage others to join us in this effort. The results should be regarded as the first step toward their objective, which is to develop a publicly accessible data base of performance information of this type.

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Refer also to citation(s) 5163, 5198, 5199, 5200, 6100, 6103, 6105, 6106, 6107, 6363, 6476

6488 (INDC(CCP)–302/L, pp. 5-13) **Neutron data evaluation activities of the Nuclear Data Centre.** Manokhin, V.N.; Blokhin, A.I. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. In *Translation of selected papers published in Nuclear Constants 4, 1986.* Order Number DE90607803. Available from NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS.

Translated by the IAEA. Original report in Russian was distributed as INDC(CCP)-268/G.

The ultimate aim of the activity of the Obninsk Nuclear Data Centre of the State Committee on the Utilization of Atomic Energy concerning neutron data, is the creation of a library of recommended evaluated neutron data files, which might serve as the basis for an improved provision of constants for reactor calculations and other scientific and technical applications. 14 refs.

6489 (INDC(CCP)–304/L, pp. 17-29) **Nuclear data libraries used at the Shkoda Power Engineering Plant.** Khep, Ya.; Valenta, V. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Sep 1989. In *Translation of selected papers published in Nuclear Constants 1, 1987.* Order Number DE90609270. Available from NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS.

Translated by the IAEA. Original report in Russian was distributed as INDC(CCP)-276/G.

In order to establish a set of programs for evaluating the radiation situation at nuclear power plants with WWER reactors during normal operation and under accident conditions, the relevant reference data have been analysed and arranged in these libraries: the BIBA library of radioactive products used to calculate the balances of activities and radiation sources resulting from the decay of corrosion products in the primary circuit, activation products in the coolant and its impurities, activation products in structural materials and so on; the BIBGRFP library of fission products used to calculate the balance of radioactivities and fission product radiation sources in fuel elements, in the primary circuit, in the nuclear power plant area and so on; the BIPAL library of actinides used to solve the equation for the balance of actinides and the members of their decay chains. 53 refs, 4 figs, 2 tabs.

6490 (INDC(NDS)–223/GF, pp. 43-45) **Status of ENDF/B-VI.** Dunford, C. International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8905244–: IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna (Austria), 8-11 May 1989). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear*

Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report. Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The status of evaluations for ENDF/B-VI is presented in a table containing the nucleus, the name of the evaluator, the due date, the review status phase I and the covariance evaluation status.

6491 (INDC(NDS)–223/GF, pp. 47-49) **Guide to JENDL-3.** Igarasi, S. (Japan Atomic Energy Research Inst., Tokai, Ibaraki (Japan). Nuclear Data Center). International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee. Aug 1989. (CONF-8905244–: IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna (Austria), 8-11 May 1989). In *Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report.* Order Number DE90609134. Available from NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS.

The nuclides to be included in the General Purpose File and in the Fission Product File of JENDL-3 are presented in two tables.

6492 (LBL–27070) **Name assignment techniques for relational schemas representing extended entity-relationship schemas.** Markowitz, V.M.; Shoshani, A. Lawrence Berkeley Lab., CA (USA). Aug 1989. 27p. Sponsored by U.S. DOE Energy Research. DOE Contract AC03-76SF00098. (CONF-8910295–2: 8. international conference on entity-relationship approach, Toronto (Canada), 18-20 Oct 1989). Order Number DE90003269. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

The mapping of Extended Entity-Relationship (EER) schemas into relational schemas involves the assignment of names to relational attributes. We propose several criteria for such name assignment, such as brevity and clarity. These name assignments must satisfy certain assumptions underlying relational normalization. We develop two name assignment algorithms that satisfy these assumptions and follow the criteria mentioned above. The first algorithm is intended for regular relational interfaces where users know both relations and attributes. The second algorithm is designed for special relational (Universal Relation) interfaces where users interact at the attribute level only and are not expected to know how attributes are grouped into relations. Both algorithms employ well known graph algorithms in order to devise appropriate name assignment strategies. 10 refs., 2 figs.

6493 (NUREG–1379) **NRC [Nuclear Regulatory Commission] editorial style guide.** Beeson, J.F.; Calure, B.A.; Gable, D.; Lesar, M.T.; Mejac, M.F.; Sanders, R.F. Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services. Oct 1989. 52p. Sponsored by Nuclear Regulatory Commission. Available from NTIS, PC A04/MF A01 - GPO; OSTI; INIS.

Editorial style refers to the choices that writers, editors, and secretaries make to eliminate inconsistencies in their documents. These choices apply to the recurrent features of a document such as abbreviations, capitalization, compound words, numbers, symbols, and punctuation, as well as to references and footnotes. Making these choices is sometimes difficult because usage changes as the language evolves. Consider the use of hyphens, for example. Do we write non-power reactor or nonpower reactor? Is it on-site incident or onsite incident? Although usage is moving away from the use of hyphens with prefixes, the authorities who compile style guides do not always agree about which choice to use at a given time. Moreover, each discipline – law, physics, mathematics – has specific standards that apply to the publications for that discipline. Even in an area as seemingly certain as spelling, overlapping usage exists. Reputable dictionaries show both "align" and "aline" as correct spellings. Likewise, "disc, disk, and diskette" currently coexist as equally valid choices.

6494 (SAND–89-2206) **Market survey of video compression systems.** Fitzgerald, D.S. Sandia National Labs., Albuquerque, NM (USA). 16 Aug 1989. 38p. Sponsored by U.S. DOE Defense Programs. DOE Contract AC04-76DP00789. Order Number DE90003186. Available from NTIS, PC A03/MF A01 - OSTI; GPO Dep.

This report presents a evaluation of ten video compression systems currently available on the market. The products are presented in a structured format for easy comparison. The features used for comparison purposes include applications, bit rates, processing delays, resolutions, color capabilities, physical size and weight, maintainability, price, and additional features. Further, unique attractions and characteristics, as well as limitations and problems, are discussed.

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This index lists the corporate authors responsible for issuing the documents in this publication which are identified primarily by report number. The corporate names are entered in standardized forms as defined in *DOE Energy Data Base: Corporate Author Entries* (DOE/TIC-4585). Each entry under a corporate name includes the document title and citation number. Three items of information may appear in parentheses: (1) an abbreviation to identify the document type, such as a report; (2) the country of publication, also abbreviated; and (3) the language of the document if non-English (R;US;In French). Author affiliations are not listed in this index.

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B

Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div.
Ancillary operations in coal preparation instrumentation: On-line low cost sulfur and ash analysis: Third quarterly report, July 1989–September 1989, 15:4553 (R;US)

Babcock and Wilcox Co., Barberton, OH (USA). Contract Research Div.
LIMB Demonstration Project Extension: Quarterly report No. 9, May–July 1989, 15:4591 (R;US)

Battelle Columbus Div., OH (USA)
Precision of the EPA seven-day Ceriodaphnia dubia survival and reproduction test: Intra- and interlaboratory study: Final report, 15:5894 (R;US)

Battelle Memorial Inst., Columbus, OH (USA)
Development of the Electroacoustic Dewatering (EAD) process for fine/ultrafine coal: Fourth quarterly progress report, period ending September 30, 1989, 15:4554 (R;US)

Battelle New England Marine Research Lab., Duxbury, MA (USA)
Socio-economic and environmental inventory of the North Atlantic Region including the outer continental shelf and adjacent waters from Sandy Hook, New Jersey, to Bay of Fundy. Volume 1. Executive summary. Final report, 15:5243 (R;US)

Bhabha Atomic Research Centre, Bombay (India)
INDHAN: an auto fuel program for PHWRS, 15:5100 (R;IN)

Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet
A study on the detection and on the mass determination of top quarks in the energy range of LEP I, 15:6057 (R;DE;In German)
Conformal invariance of the spin-1 XXZ chain and the operator content of supersymmetric models with central charge $c < 3/2$, 15:6075 (R;DE;In German)
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Bonn Univ. (Germany, F.R.). Physikalisches Inst.
A study on the detection and on the mass determination of top quarks in the energy range of LEP I, 15:6057 (R;DE;In German)
Conformal invariance of the spin-1 XXZ chain and the operator content of supersymmetric models with central charge $c < 3/2$, 15:6075 (R;DE;In German)
Measurement of the positron-drift time relation of a high-pressure drift chamber, 15:5731 (R;DE;In German)

Brigham Young Univ., Provo, UT (USA). Combustion Lab.
Effective sorbent mixing in a simulated entrained-flow coal reactor: A coal flow study, 15:4590 (R;US)

Bronx Community Coll., New York, NY (USA)
Labor market analysis and development of a prototype program for minority entrepreneurs: Final report, 15:5235 (R;US)

Brookhaven National Lab., Upton, NY (USA)
A low pressure, parallel plate avalanche chamber for detection of soft x-ray fluorescence, 15:5789 (R;US)
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Core damage vulnerability due to the loss of ESW [essential service water] systems at multiplant sites: An assessment and options, 15:5173 (R;US)
Economical clean carbon fuel and co-product gaseous and liquid fuel from coal, 15:4558 (R;US)
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X-ray absorption studies of $YBa_2Cu_3O_{6+x}$, $La_{2-x}Sr_xCuO_4$, and $Nd_{2-x}Ce_xCuO_4$, 15:5474 (R;US)
[Accelerators of heavy ions]: Foreign trip report, September 29–October 18, 1989, 15:5706 (R;US)
[Gallium solar neutrino experiment]: Foreign trip report, September 18–September 27, 1989, 15:5988 (R;US)
[Manufacturing the dipole magnets for the HERA Project at DESY]: Foreign trip report, October 11, 1989–October 24, 1989, 15:5728 (R;US)
[Radioactive waste management]: Foreign trip report, October 20–29, 1989, 15:4772 (R;US)
[Recent progress in development of high-rate, position sensitive, x-ray detectors at Brookhaven]: Foreign trip report, September 30, 1989–October 11, 1989, 15:5739 (R;US)

Brown Univ., Providence, RI (USA). Dept. of Geological Sciences
Thermal regimes of major volcanic centers: Magnetotelluric constraints: Final report, 15:4959 (R;US)

Bundesministerium fuer Umwelt, Naturschutz und Reaktorsicherheit, Bonn (Germany, F.R.)
Comparison of FIPLOC-M with FIRAC computations on aerosol release in the event 'earthquake with subsequent solvent fine', 15:4757 (R;DE;In German)

Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia)
Union list of Australian geological excursion guide books, 15:4631 (R;AU)

Bureau of Mines, Pittsburgh, PA (USA)
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Model of coal dust explosion suppression by rock dust entrainment, 15:4670 (R;US)
Rollover Protective Structure (ROPS) performance criteria for large mobile mining equipment, 15:4650 (R;US)
Thermal characteristics of energized coal mine trailing cables, 15:4673 (R;US)

C

California Inst. of Tech., Pasadena, CA (USA). Graduate Aeronautical Labs.
Rayleigh-Taylor instability in compressible fluids: Final report, 1 October 1988–30 September 1989, 15:5657 (R;US)

California Univ., Davis, CA (USA). Dept. of Wildlife and Fisheries Biology
The ecology of the Sacramento-San Joaquin Delta: A community profile, 15:5885 (R;US)

California Univ., Los Angeles, CA (USA)
NET plasma facing materials behaviour under erosion and redeposition regimes in PISCES, 15:6357 (R;IT)
Oxide ceramic fibers by the sol-gel methods. Final report, December 1986-February 1988, 15:5469 (R;US)

California Univ., Santa Barbara, CA (USA). Dept. of Chemical and Nuclear Engineering
Performance of the liquid reactivity control system in BWRs [boiling water reactors], 15:5150 (R;US)

California Univ., Santa Barbara, CA (USA). Dept. of Physics
Monitor and control systems for the SLD Cherenkov Ring Imaging Detector, 15:5782 (R;US)

California Univ., Santa Cruz, CA (USA). Inst. for Particle Physics
Tracking requirements for the SSC and silicon strip development, 15:5780 (R;US)

Canada Centre for Mineral and Energy Technology, Ottawa, ON (Canada). Energy Research Labs.
Energy Research Laboratories annual report, 1987-88, 15:5258 (R;CA)

Canadian Electrical Association, Montreal, PQ (Canada)
[Canadian Electrical Association] Research implementation, 15:5213 (R;CA)

Canadian Energy Research Inst., Calgary, AB (Canada)
Industrial natural gas demand, 15:4715 (R;CA)
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Reserves of hydrocarbons in Alberta: A review of Canadian Petroleum Association and Alberta Energy Resources Conservation Board estimates and methodology, 15:4713 (R;CA)

Canadian Gas Association, Don Mills, ON (Canada). Economics/Statistics Dept.
Directory of gas distribution transmission and production companies, 1988, 15:4727 (R;CA)

Canadian Gas Processors Association, Calgary, AB (Canada)
Expanded markets: Meeting the challenge and avoiding the pitfalls, 15:4711 (R;CA)

Canadian Gas Processors Suppliers Association, Calgary, AB (Canada)
Expanded markets: Meeting the challenge and avoiding the pitfalls, 15:4711 (R;CA)

Canadian Heavy Oil Association (Canada)
Environment & surface facilities challenges. Proceedings [of the] quarterly meeting of the Canadian Heavy Oil Association, 15:4737 (R;CA)
Environment & surface facilities challenges. Proceedings [of the] quarterly meeting of the Canadian Heavy Oil Association, 15:4736 (R;CA)

Carl Bro Gruppen, Glostrup (Denmark)
Agitation and scum abatement in bioconversion plants: Technical evaluation of stirring systems, 15:4914 (R;DK;In Danish)

CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)
CEA Benchmark results on a Cray Y-MP/832, 15:6471 (R;FR;In French)

CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. d'Etudes Mecaniques et Thermiques
Modelization of ratcheting in biaxial experiments, 15:5406 (R;FR;In French)

Central Electricity Generating Board, Berkeley (UK). Berkeley Nuclear Labs.
$^{10}B(n,\alpha)^{7}Li$ reaction in PWR coolants: calculations of the effect on coolant pH and on decreases in ^{10}B isotopic fractions, 15:5008 (R;GB)
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Extrapolation ionisation chamber measurements on beta-emitting sources produced for the CEGB collaborative radiobiology programme, 15:5733 (R;GB)
INDAR: a computer code for the calculation of critical group radiation exposure from routine discharges of radioactivity to seas and estuaries - description and users' guide, 15:6189 (R;GB)
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Radioactive inventory of a Dungeness 'A' heat exchanger, 15:5075 (R;GB)
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Central Electricity Generating Board, Southampton (UK). Marchwood Engineering Labs.
Multilink manipulator computer control: experience in development and commissioning, 15:5623 (R;GB)
Non-contacting thermal wave technique for NDT of coatings and other applications in the CEGB: current status (July 1987), 15:5664 (R;GB)
NUMAC-PWR: a PWR steam generator model for operational dynamics and control system studies, 15:5011 (R;GB)
Reference stress approach for the characterisation of the creep failure of dissimilar welds under isothermal conditions, 15:5410 (R;GB)
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Central Electricity Research Labs., Leatherhead (UK)
Applications and real life spectra in the power generation industry, 15:4976 (R;GB)
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Plume tracer experiments at Hinkley Point 'A' [Nuclear Power Station] during 1987, 15:5819 (R;GB)

Verification of failure avoidance concepts in R6 Rev3, 15:5121 (R;GB)

Central Research Inst. of Electric Power Industry, Komae, Tokyo (Japan). Energy and Environment Lab.
Analysis of infrared radiation heating Part 1. One dimensional radiation heat transfer analysis taking account of spectral properties, 15:5648 (R;JP;In Japanese)
Development of autonomous decentralized preventive control system. Prevention of overload and abnormal voltage using decomposition principle, 15:4977 (R;JP;In Japanese)
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Survey on application of electrohydro-dynamics (EHD), 15:5288 (R;JP;In Japanese)

Central Research Inst. of Electric Power Industry, Tokyo (Japan)
Design study of undergrounding distribution facilities in urban street space, 15:5370 (R;JP;In Japanese)

Centro de Desenvolvimento da Tecnologia Nuclear, Belo Horizonte, MG (Brazil)
Measures 'in situ' of suspendent sediment concentration. Development of an instrument based on the principle of gamma radiation transmission, 15:5753 (R;BR;In Portuguese)

Centro Tecnico Aeroespacial, Sao Jose dos Campos, SP (Brazil). Inst. de Estudos Avancados
Cross sections of the lumped fission products for the AMZ library, 15:5113 (R;BR;In Portuguese)
Development and implantation of application systems for reduction and analysis of experimental data in Nuclear Physics area, 15:6100 (R;BR;In Portuguese)
Estimate of maximum excursion power due to reactivity insersion in system using a reactor nodal model, 15:5114 (R;BR;In Portuguese)

Ceramatec, Inc., Salt Lake City, UT (USA)
New mechanism for toughening ceramic materials. Final report, 15 July 1987-14 December 1988, 15:5472 (R;US)

Ceskoslovenska Vedeckotechnicka Spolecnost, Prague (Czechoslovakia). Dum Techniky
VII international district heating conference, 15:4992 (R;CS;In French, English, Russian, Czech,)

Chester and Schmidt Consultants, Oakland, CA (USA)
Status of static UPS [uninterruptible power supplies] applications in the United States: Final report, 15:5686 (R;US)

Christensen (Laurits R.) Associates, Inc., Madison, WI (USA)
Feasibility of conducting an electricity real-time pricing experiment in maryland. Research report 15 June 1987-30 November 1989, 15:5280 (R;US)

Coal Mining Research Centre, Edmonton, AB (Canada)
Draft guidelines of procedure for surveying underground mines in Alberta, 15:4632 (R;CA)

Coal Mining Research Centre, Tokyo (Japan)
Proceeding of the 10th presentation meeting on coal utilization technology 1988, 15:4589 (R;JP;In Japanese)
Proceeding of the 9th Presentation Meeting on Coal Utilization Technology, 15:4551 (R;JP;In Japanese)

Combustion and Engineering, Ottawa, ON (Canada)
Demonstration of a modified combustion emission control system with sorbent injection for NO^x and SO^2 reduction: Volume 1, 15:4987 (R;CA)
Demonstration of a modified combustion emission control system with sorbent injection for NO^x and SO^2 reduction: Volume 2: Appendices, 15:4988 (R;CA)

Comision Nacional de Energia Atomica, Buenos Aires (Argentina). Dept. de Materiales
Point defects dynamics in a stress field: Application to hexagonal close packed metals, 15:6219 (R;AR;In Spanish)

Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil). Dept. de Normas e Especificacoes
Functioning of industrial radiography services, 15:6190 (R;BR;In Portuguese)

Comissao Nacional de Energia Nuclear, Rio de Janeiro, RJ (Brazil). Dept. de Reatores
Power distribution and hot channel factor used in Angra 1 (W) and Angra 2,3 (KWU), 15:5012 (R;BR;In Portuguese)
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Utilization of Quabox/Cubox computer program for calculating Angra 1 Reactor core, 15:5023 (R;BR;In Portuguese)

Comitato Nazionale per l'Energia Nucleare, Bologna (Italy)
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Comitato Nazionale per l'Energia Nucleare, Bologna (Italy). Dipt. Tecnologie Intersettoriali di Base
Thermal radiation in a diffuse-gray enclosure, 15:5649 (R;IT)

Comitato Nazionale per l'Energia Nucleare, Saluggia (Italy)
Radionuclides behaviour in the Po River ecosystem (Italy) after the Chernobyl accident, 15:5893 (R;IT)

Comitato Nazionale per l'Energia Nucleare, Saluggia (Italy). Dipt. Ciclo del Combustibile
9elected separation of actinides and long lived fission products from aged liquid wastes produced by the EUREX plant at Saluggia (Italy), 15:4779 (R;IT)

Commission of the European Communities, Brussels (Belgium)
Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988, 15:5078 (R;XA)

Commission of the European Communities, Geel (Belgium). Central Bureau for Nuclear Measurements
Nuclear measurements and reference materials Programme progress report, January - December 1987, 15:6459 (R;FR)

Commission of the European Communities, Luxembourg (Luxembourg)
Performance assessment of geological isolation systems for radioactive waste. Summary, 15:4781 (R;FR)
Round table meeting 'chemical and physical valorization of coal', 15:4569 (R;XE;In English, French or German)

Consiglio Nazionale delle Ricerche, Rome (Italy). Progetto Finalizzato Energetica
4th International symposium on second law analysis of thermal systems, 15:5568 (R;IT;In Italian)
Bioclimatic architecture, energy conservation and environmental quality. Prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988, 15:4936 (R;IT;In Italian)
Volumetric properties of organic fluids for direct and inverse thermodynamic cycles, 15:4996 (R;IT)

Coordinating Research Council, Inc., Atlanta, GA (USA)
Program to evaluate a vehicle test method for port fuel-injector deposit-forming tendencies of unleaded base gasolines, 15:4695 (R;US)

Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science
An investigation of mechanical behavior of crystalline solids: Final report for the period of March 1984–June 1988, 15:5423 (R;US)

Council on Environmental Quality, Washington, DC (USA)
Risk analysis: A guide to principles and methods for analyzing health and environmental risks, 15:5952 (R;US)

Cranfield Inst. of Tech., Bedford (UK). Marine Technology Centre
Further period in the development of an expert system for assessment of corrosion risks on offshore submarine pipelines, 15:4706 (R;GB)

CSR, Inc., Washington, DC (USA). Power Information Center
Semiannual compilation of Project Briefs, August 1989 (Power Information Center), 15:5286 (R;US)

D

Dartmouth Coll., Hanover, NH (USA). Thayer School of Engineering
Thermomechanical contact phenomena and wear of sliding components. Final report, 1 January 1987-31 December 1988, 15:5662 (R;US)

Dearborn Environmental Consulting Group, Mississauga, ON (Canada)
Characterization of circulating AFBC [atmospheric fluidized bed combustion] wastes, 15:4640 (R;CA)

Department of Atomic Energy, Bombay (India)
Annual report 1987-88, 15:6454 (R;IN)

Department of Energy, London (UK)
Further period in the development of an expert system for assessment of corrosion risks on offshore submarine pipelines, 15:4706 (R;GB)
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Semisubmersible data base. V. 1: Final project report, 15:5676 (R;GB)

Department of Energy, London (UK). Offshore Energy Technology Board
Sensitivity of shallow water jacket structures to uncertainties in environmental loading, 15:5675 (R;GB)

Department of Energy, Mines and Resources, Ottawa, ON (Canada). Remote Community Demonstration Program
R-2000 Band office of the Hatchet Lake Band, Wollaston Lake, Saskatchewan: Final report, 15:5323 (R;CA)
Residential training and retrofit project: Final report, 15:5322 (R;CA)

Department of the Environment, London (UK)
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Transport mechanisms and rates for the long-lived Chernobyl deposits, 15:5891 (R;GB)

Department of the Secretary of State of Canada, Montreal, PQ (Canada). Terminology and Linguistic Services Branch
Vocabulary of the transportation of dangerous goods, 15:5880 (R;CA)

E

Ecole Centrale des Arts et Manufactures, 92 - Chatenay-Malabry (France)
Contribution to the study of modeling of atmospheric gas-oil cut cracking testing. Kinetics model, 15:4691 (R;FR;In French)

Economist Intelligence Unit, London (UK)
Natural gas in Western Europe: Economic or managed markets?, 15:4720 (R;GB)

EG and G Idaho, Inc., Idaho Falls, ID (USA)
BWR reactor water cleanup system flexible wedge gate isolation valve qualification and high energy flow interruption test: Analysis and conclusions: Volume 1, 15:5203 (R;US)
BWR reactor water cleanup system flexible wedge gate isolation valve qualification and high energy flow interruption test: Data report, 15:5006 (R;US)
BWR reactor water cleanup system flexible wedge gate isolation valve qualification and high energy flow interruption test: Review of issues associated with BWR containment isolation valve closure: Volume 3, 15:5204 (R;US)
Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR): User's guide: Part 1, Overview of NUCLARR data retrieval, 15:5198 (R;US)
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TMI-2 degraded core heatup and cooldown analysis, 15:5178 (R;US)
Waste heat recovery, 15:5358 (R;US)

EG and G, Inc., Las Vegas, NV (USA). Remote Sensing Lab.
An aerial radiological survey of the Braidwood Generating Station and surrounding area, Braidwood, Illinois, August 1988, 15:5854 (R;US)

Electric Power Research Inst., Palo Alto, CA (USA)
Dissimilar-weld failure analysis and development program: Volume 8, Design and procedure guide for improved welds: Final report, 15:4978 (R;US)
Fiber-optic sensing workshop: Proceedings, 15:5791 (R;US)
Guidelines for prevention of cavitation in centrifugal feedpumps: Final report, 15:4979 (R;US)
Methods for assessing the stability and compatibility of residual fuel oils: Final report, 15:4708 (R;US)
Office productivity and workstation environment control workshop: Research planning: Proceedings, 15:5321 (R;US)
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Voice communication systems compatible with respiratory protection: Final report, 15:5182 (R;US)

Electrotechnical Lab., Tsukuba, Ibaraki (Japan)
Fabrication of S-N-S josephson junctions of Y-Ba-Cu-O/Au/Nb thin film sandwiches, 15:5640 (R;JP)
New Tl-Ba-Ca-Cu-O (1234 and 1245) superconductors with T_c >117k, 15:5505 (R;JP)

Elektronikcentralen, Hoersholm (Denmark)
Preliminary investigation of Faraday rotation effects and description of polarization measurements on the AFGL (Air Force Geophysics Lab) high-latitude meteor scatter test bed. Final report, June 1988-May 1989, 15:6008 (R;DK)

Emerald Exploration Consultants, Inc., Austin, TX (USA)
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Reprocessing and interpretation, seismic reflection data: Hanford Site, Pasco Basin, south central Washington, 15:4832 (R;US)

ENEA, Bologna (Italy). Dipt. Reattori Veloci
On the numerical solution of flow transients induced in fluids by moving walls: A one-dimensional treatment, 15:5650 (R;IT)

ENEA, Bologna (Italy). Dipt. Tecnologie Intersettoriali di Base
A collection of electron excitation collision strengths for iron ions : Fe 26-Fe 18, 15:6023 (R;IT)

ENEA, Casaccia (Italy). Centro Ricerche Energia
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ENEA, Casaccia (Italy). Dipt. Fonti Alternative Rinnovabili e Risparmio Energetico
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ENEA, Casaccia (Italy). Dipt. Protezione Ambientale e Salute dell'Uomo
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ENEA, Casaccia (Italy). Dipt. Tecnologie Intersettoriali di Base
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ENEA, Frascati (Italy). Centro Ricerche Energia
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ENEA, Rome (Italy)
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SPES: PWR reactor test facility description. Vol. 2. Facility characterization, 15:5016 (R;IT)
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Well-posedness of the magnetoplasmastatic problem with anisotropic stress tensor, 15:6041 (R;IT)
Wind tunnel measurements of aerodynamic coefficients of asymetrical airfoil sections: wind turbine blades extended to high angles of attack, 15:4969 (R;IT)

ENEA, Saluggia (Italy). Dipt. Ciclo del Combustibile
Rendering inert toxic and noxious wastes. Part two. Process based on methods for solidification of radioactive wastes in cement matrices, 15:5627 (R;IT;In Italian)

ENEA, Trisaia (Italy). Dipt. Ciclo del Combustibile
On-line control systems for solvent extraction processes: Feedback regulation of solvent, 15:5542 (R;IT;In Italian)
Rendering inert toxic and noxious wastes. Part one. Process based on methods for solidification of radioactive wastes in polymer matrices, 15:5628 (R;IT;In Italian)

Energy and Environmental Research Corp., Irvine, CA (USA)
Advanced coal-fueled combustor for residential space heating applications: Prototype design report, 15:4643 (R;US)

Energy Resources Conservation Board, Calgary, AB (Canada)
Unocal Canada Mangement Limited application for approval of a sweet gas processing plant Albright and Beaverlodge fields, 15:4725 (R;CA)

Ente Nazionale per l'Energia Elettrica, Milan (Italy)
Model qualification of a nuclear power plant engineering simulator, 15:5145 (R;IT)

Ente Nazionale per l'Energia Elettrica, Milan (Italy). Centro Termica e Nucleare
Radionuclides behaviour in the Po River ecosystem (Italy) after the Chernobyl accident, 15:5893 (R;IT)

Environment Canada, Moncton, NB (Canada). Inland Waters Directorate
Long range transport of airborne pollutants (LRTAP) aquatic effects monitoring, 15:5892 (R;CA)

Environment Canada, Ottawa, ON (Canada)
Estimating effects of climatic change on agriculture in Saskatchewan, Canada, 15:5238 (R;CA)

Environment Canada, Ottawa, ON (Canada). Conservation and Protection
Response techniques for the cleanup of sinking hazardous materials, 15:5889 (R;CA)
The evaluation of mobile and stationary facilities for the destruction of PCBs, 15:5849 (R;CA)

Environment Canada, Ottawa, ON (Canada). Inland Waters Directorate
Long range transport of airborne pollutants (LRTAP) aquatic effects monitoring, 15:5892 (R;CA)

Quebec historical water levels summary, to 1987, 15:4923 (R;CA;In English and French)

Environment Canada, Quebec, PQ (Canada). Inland Waters Directorate

Long range transport of airborne pollutants (LRTAP) aquatic effects monitoring, 15:5892 (R;CA)

Environment Canada, Saskatoon, SK (Canada). National Hydrology Research Inst.

Long range transport of airborne pollutants (LRTAP) aquatic effects monitoring, 15:5892 (R;CA)

Environmental Protection Agency, Ada, OK (USA). Robert S. Kerr Environmental Research Lab.

In-situ bioremediation of spills from underground storage tanks: New approaches for site characterization project design, and evaluation of performance. Final report, 1985-1989, 15:4700 (R;US)

Environmental Protection Agency, Ann Arbor, MI (USA)

Cold starting a neat methanol (M100) vehicle with long-duration spark ignition. Technical report, 15:5393 (R;US)

Environmental Protection Agency, Ann Arbor, MI (USA). Emission Control Technology Div.

Derivation of technology specific effects of the use of oxygenated fuel blends on motor-vehicle exhaust emissions. Technical report, 15:5386 (R;US)

Environmental Protection Agency, Ann Arbor, MI (USA). Technical Support Staff

MOBILE4 oxygenated-fuels version user's guide. Technical report, 15:5387 (R;US)

Environmental Protection Agency, Cincinnati, OH (USA). Hazardous Waste Engineering Research Lab.

Technologies for the recovery of solvents from hazardous wastes, 15:5363 (R;US)

Environmental Protection Agency, Gulf Breeze, FL (USA). Environmental Research Lab.

Direct viable counting method for measuring tolerance of aquatic microbial communities to Hg(2+1), 15:5954 (R;US)

Environmental Protection Agency, Research Triangle Park, NC (USA). Air and Energy Engineering Research Lab.

Assessing potential effects of incinerating organic wastes at sea: Development and field testing of the Marine Incineration Biological Assessment Sampler, 15:5364 (R;US)

Calcium oxide sintering in atmospheres containing water and carbon dioxide, 15:4593 (R;US)

Sintering of nascent calcium oxide, 15:4595 (R;US)

Structural changes in surfactant-modified sorbents during furnace injection, 15:4594 (R;US)

Technical issues related to emission releases from subslab radon mitigation systems, 15:5838 (R;US)

Environmental Protection Agency, Research Triangle Park, NC (USA). Atmospheric Sciences Research Lab.

Influence of ambient temperature on tailpipe emissions from 1984-1987 model year light-duty gasoline motor vehicles, 15:5388 (R;US)

Environmental Protection Agency, Research Triangle Park, NC (USA). Health Effects Research Lab.

Inhalation toxicology of red and violet dye mixtures. Phase 1. Engineering report. Report for 15 March 1987-1 November 1988, 15:5950 (R;US)

Environmental Protection Agency, Research Triangle Park, NC (USA). Office of Air Quality Planning and Standards

Sulfur oxides emissions from fluid catalytic-cracking unit regenerators: Background information for promulgated standards. Environmental impact statement (Final), 15:4692 (R;US)

EXPORTech Co., Inc., New Kensington, PA (USA)

Pitt Mill demonstration: Quarterly technical progress report, July 1, 1989–September 30, 1989, 15:4555 (R;US)

F

Factory Mutual Research Corp., Norwood, MA (USA)

Fire protection survey: Revisit No. 2, 15:5965 (R;US)

Fermi National Accelerator Lab., Batavia, IL (USA)

Cosmic strings and baryon decay catalysis, 15:6077 (R;US)

Designing machines for lattice physics and algorithm investigation, 15:6080 (R;US)

Fluxes and background from $\Sigma^+ \rightarrow$ polarized proton at Fermilab, 15:6054 (R;US)

Small scale structure on cosmic strings, 15:5989 (R;US)

Finnish Centre for Radiation and Nuclear Safety (STUK), Helsinki (Finland). Dept. of Nuclear Safety

Operation of Finnish nuclear power plants. Quarterly report 3. quarter 1987, 15:5071 (R;FI)

Fish and Wildlife Service, Washington, DC (USA)

Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic): Atlantic marsh fiddler, 15:5847 (R;US)

The ecology of the Sacramento-San Joaquin Delta: A community profile, 15:5885 (R;US)

The ecology of the seagrass meadows of the west coast of Florida: A community profile, 15:5886 (R;US)

Flight Refuelling Ltd., Wimborne (UK)

Characterisation of wind turbine wake turbulence and its implications on wind farm spacing: (Wake turbulence characterisation), 15:4970 (R;GB)

Food and Drug Administration, Rockville, MD (USA). Center for Devices and Radiological Health

Clarification of radiation-control regulations for diagnostic x-ray equipment, 15:5926 (R;US)

Forsvarshistorisk Forskningssenter, Oslo (Norway)

On the search for uranium. Institutt for atomenergi and international cooperation 1945-51, 15:5169 (R;NO;In Norwegian)

Foster-Miller, Inc., Waltham, MA (USA)

Fiber-optic sensing workshop: Proceedings, 15:5791 (R;US)

Fuel Society of Japan, Tokyo (Japan)

Proceeding of the 24th Coal Science Conference 1987, 15:4576 (R;JP;In Japanese)

Proceeding of the 25th Coal Science Conference (1988), 15:4552 (R;JP;In Japanese)

FURNAS, Rio de Janeiro, RJ (Brazil). Dept. de Planejamento Energetico

Economic evaluation of three and four regions reactor core in Angra 1, 15:5019 (R;BR;In Portuguese)

G

General Atomics Co., San Diego, CA (USA)

Shutdown cooling helium circulator design considerations for MHTGR [Modular High Temperature Gas-Cooled Reactor] power plant, 15:5077 (R;US)

General Atomics, San Diego, CA (USA)

Innovative design concepts for the LMF target chamber and related systems: Final report, April 1988–March 1989, 15:6329 (R;US)

Geological Survey of Canada, Ottawa, ON (Canada)

Report of activities, 1988: Resident geologists, 15:4674 (R;CA)

Report of activities, 1988: Resident geologists, 15:5970 (R;CA)

George Washington Univ., Washington, DC (USA). Dept. of Chemistry

Quantitative interpretation of Auger line shapes and electron/photon stimulated desorption. Final report, 1 July 1980-31 March 1989, 15:6218 (R;US)

Georgia Inst. of Tech., Atlanta, GA (USA)

Design and testing of a thermal liquid level sensor: Final report, 15:5128 (R;US)

Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)

Comparison of FIPLOC-M with FIRAC computations on aerosol release in the event 'earthquake with subsequent solvent fine', 15:4757 (R;DE;In German)

Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)

Influence of radiation quality on heavy ion induced chromosome aberrations in V79 cells, 15:5934 (R;DE)

GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)

Formation of titanium aluminides by heat treatment of extruded elemental powders, 15:5427 (R;DE)

Total reflection X-ray spectrometry: Method and applications, 15:5543 (R;DE)

Golder Associates, Inc., Bellevue, WA (USA)
Proposed methodology for completion of disruptive scenario analysis, 15:4820 (R;US)

Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Inst. Atomnoj Ehnergii
Alpha and gamma spectroscopy of fission isomers, 15:6130 (R;SU;In Russian)
Dynamic features of densofication of uranium dioxide under irradiation, 15:5488 (R;SU;In Russian)
On the irradiation action on the structure-dynamic chracteristics of uranium dioxide, 15:5487 (R;SU;In Russian)

Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow (USSR). Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike
Welding in nuclear technology. Scientific-technical collection, 15:5433 (R;SU)

Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.
Solution of the quasistationary problem of neutron transport in the MCDEN and MCDENSP programs, 15:5115 (R;SU;In Russian)

Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij
Classical mechanics on superspace, 15:6273 (R;SU;In Russian)
Magnetic characteristics of St3 steel at 4.2-300 K, 15:5428 (R;SU;In Russian)
Note on path integral quantization of hydrogen atom, 15:6272 (R;SU)
Straight-line string in the background electromagnetic field, 15:6090 (R;SU;In Russian)

Great Lakes Fishery Commission, Ann Arbor, MI (USA)
Apparatus for neutron-scattering measurements on sheared fluids, 15:5779 (R;US)

H

Hawaii Natural Energy Inst., Honolulu, HI (USA)
The third Pacific Basin biofuels workshop: Proceedings, 15:4906 (R;US)

Heidelberg Univ. (Germany, F.R.). Physikalisches Inst.
Electron attachment to oxygen, water, and methanol, in various drift chamber gas mixtures, 15:6024 (R;DE)

Hydro Geo Chem., Inc., Tucson, AZ (USA)
Assessment of the Rockwell Hanford isotope and geochemical hydrology program, Pasco Basin, Washington, 15:4775 (R;US)

Hydro-Quebec, Montreal, PQ (Canada)
Electricity demand in Quebec. 2006 outlook, 15:5277 (R;CA)
Environment and development [Hydro-Quebec], 15:5239 (R;CA)
Hydro-Quebec development plan, 1988-1990. 1997 outlook. Abridged version, 15:5230 (R;CA)
Hydro-Quebec development plan, 1988-1990. 1997 outlook. Full-length version, 15:5231 (R;CA)
Hydro-Quebec development plan, 1989-1991. 1998 outlook, 15:5278 (R;CA)
Hydro-Quebec development plan, 1989-1991. 1998 outlook: Hydro-Quebec and the environment, 15:5240 (R;CA)

I

Idaho Univ., Moscow, ID (USA). Coll. of Mines and Earth Resources
Electrochemistry of Thiobacillus ferrooxidans reactions with pyrite: Technical progress report, August 15–October 15, 1989, 15:4566 (R;US)

IEA Coal Research, London (UK)
Market impacts of sulphur control: The consequences for coal, 15:4592 (R;GB)

Illinois Environmental Protection Agency, Springfield, IL (USA). Div. of Land Pollution Control
Summary of annual reports on hazardous waste for 1984 through 1987: Generation, treatment, storage, and disposal, 15:5361 (R;US)

Illinois Univ., Chicago, IL (USA). Lab. for Atomic Molecular and Radiation Physics
Laser production of soft x-rays by multiquantum processes and the excitation of atomic inner-shell states. Progress report, 15:6017 (R;US)

Illinois Univ., Urbana, IL (USA)
Thin films under chemical stress: Progress report, July 1–July 31, 1989, 15:5511 (R;US)

Illinois Univ., Urbana, IL (USA). Dept. of Chemistry
SANS (Small Angle Neutron Scattering) of catalyst on the growth process of silica gels, 15:5540 (R;US)

Infiltec, Falls Church, VA (USA)
Influences of HVAC (heating, ventilating, and air conditioning) design and operation on radon mitigation of existing school buildings. Report for December 1987-March 1989, 15:5340 (R;US)

Institut de Recherche d'Hydro-Quebec, Varennes, PQ (Canada)
Artificially commutated HVDC inverters, 15:5215 (R;CA)
Characterization of secondary arcing faults: Part 1: General characteristics, 15:5217 (R;CA)
Study of nuisance fuse operation on MV [medium voltage] power lines during electrical storms, 15:5218 (R;CA)

Institute for Nuclear Studies, Otwock-Swierk (Poland)
Electron linear accelerator for industrial radiography, 15:5708 (R;PL;In Polish)

Institute of Atomic Energy, Otwock-Swierk (Poland)
Industrial applications of radioisotope techniques in Poland, 15:4904 (R;PL)

Institute of Gas Technology, Chicago, IL (USA)
Molecular biological enhancement of coal biodesulfurization: Fourth quarter report, August–October 1989, 15:4565 (R;US)

Institute of Nuclear Chemistry and Technology, Warsaw (Poland)
Time regimes optimization of the activation-measurement cycle in neutron activation analysis, 15:5551 (R;PL;In Polish)

Institute of Nuclear Physics, Cracow (Poland)
Dielectric relaxation spectra of liquid crystals in relation to molecular structure, 15:6030 (R;PL)
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Mixed field dosimetry at U-120 cyclotron neutron therapy beam: a comparison of two dosimetry systems, 15:6212 (R;PL)
Molecular reorientations in a substance with liquid-crystalline and plastic-crystalline phases, 15:6029 (R;PL)
Molecular reorientations in the nematic and rotatory phases of di-n-pentyloxyazoxybenzene, 15:6027 (R;PL)
Neutron scattering study of molecular motions in the naphthalene-tetracyanobenzene complex, 15:6028 (R;PL)
Preparation of rock samples for measurement of the thermal neutron macroscopic absorption cross-section, 15:5870 (R;PL;In Polish)
Production and collective motion of qq-bar plasma in heavy ion collisions, 15:6171 (R;PL)
Pseudorapidity distributions from pion-emulsion interactions in the energy range 60 GeV to 300 GeV, 15:6108 (R;PL)
Report from the investigation of some radiation consequences of Chernobyl catastrophe in Radiation Protection Measurement Service, 15:5193 (R;PL;In Polish)

Report from the results of measurements of radioactive contaminations after Chernobyl accident, 15:5873 (R;PL;In Polish)
Report to the International Atomic Energy Agency: Agency Research Contract no 4121/RB, 15:5872 (R;PL)
Rutherford backscattering, Coulomb excitation, and X-rays production studied in channeling conditions, 15:6230 (R;PL)
The Lie algebra of the post-Galilean relativity group, 15:6274 (R;PL)
The quasielastic neutron scattering study of the reorientation of the 1,2-bis [4-decyloxybenzoyl]-hydrazine molecules, 15:6026 (R;PL)

Institute of Occupational Medicine, Edinburgh (UK)
Causes of disability in coalminers: a clinico-pathological study of emphysema, airways obstruction and massive fibrosis, 15:4652 (R;GB)
Development of a prototype powered helmet respirator suitable for use in coalmines, 15:4651 (R;GB)

Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil). Dept. de Reatores
Study of the production conditions of ^{99}Mo from the irradiation of uranium dioxide in a radioisotope production reactor, 15:5171 (R;BR;In Portuguese)

Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil). Div. de Mecanica Estrutural
POS2D: a graphic program for analysing axyssimetric and two-dimensional structures, 15:6474 (R;BR;In Portuguese)
POS2D: user manual, 15:6462 (R;BR;In Portuguese)

Instituto de Engenharia Nuclear, Rio de Janeiro, RJ (Brazil). Div. de Termohidraulica de Reatores
Turbulent flow in rod bundles, 15:5652 (R;BR;In Portuguese)

Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil)
Implantation of a integrated system for microcomputers of data processing in radioimmunoassay, 15:5915 (R;BR;In Portuguese)
Measurement and calculation of spatial and energetic neutron flux in the IEA-R1 reactor core, 15:5168 (R;BR;In Portuguese)
Nuclear option and the technical and economical viability for constructing small nuclear power reactors in some brazilian regions, 15:5260 (R;BR;In Portuguese)
Study of reactor analysis code available at Ipen and their application to the time dependent problems, 15:5119 (R;BR;In Portuguese)
Study of reactor analysis codes available at IPEN and their application to problems involving the diffusion theory, 15:5118 (R;BR;In Portuguese)

Instituto de Pesquisas Energeticas e Nucleares, Sao Paulo, SP (Brazil). Div. de Fisica de Reatores
Nuclear power plants of small and medium size, safety, a technological option in developing countries for the next decade, 15:4989 (R;BR;In Portuguese)

Instituto Militar de Engenharia, Rio de Janeiro, RJ (Brazil)
Computer code to simulate transients in a steam generator of PWR nuclear power plants, 15:5021 (R;BR;In Portuguese)

Institutt for Energiteknikk, Kjeller (Norway)
Annual report 1988. Institutt for energiteknikk, 15:5195 (R;NO)
Nuclear power - status and development 1988/1989, 15:5109 (R;NO;In Norwegian)

Institutt for Forsvarsstudier, Oslo (Norway)
Atoms for war or peace?. The establishment of the Norwegian Institutt for atomenergi 1945-1948, 15:5170 (R;NO;In Norwegian)

International Atomic Energy Agency, Seibersdorf (Austria). Analytical Quality Control Services
AQCS 1989 - Intercomparison runs reference materials, 15:5552 (R;XA)

International Atomic Energy Agency, Vienna (Austria)
Application of probabilistic safety assessment to research reactors. Report prepared within the framework of an International Atomic Energy Agency Co-ordinated Research Programme, 15:5186 (R;XA)
Bioavailable iron in typical Thai meals: Comparative studies between radioactive in vitro and in vivo food iron absorption measurements. Final report for the period 1 November 1986 - 31 October 1987, 15:5927 (R;XA)
Chemical and isotopic composition of marine organic matter as indicators of its origin. Final report for the period 15 December 1987 - 14 December 1988, 15:5895 (R;XA)
Communications received from certain Member States regarding guidelines for the export of nuclear material, equipment or technology, 15:4890 (R;XA)
Communications received from certain Member States regarding guidelines for the export of nuclear material, equipment or technology, 15:4891 (R;XA)
Development of a personal computer based facility-level SSAC component and inspector support system. Final report for the period 1 January 1987 - 30 June 1989, 15:4887 (R;XA)
Energy and nuclear power planning study for Thailand. Report prepared by a team of experts from several agencies and organizations of Thailand with guidance of the IAEA, 15:5108 (R;XA)
Fission molybdenum for medical use. Proceedings of a technical committee meeting held in Karlsruhe, 13-16 October 1987, 15:4893 (R;XA)
International Centre for Theoretical Physics, Trieste: Scientific activities in 1988, 15:6460 (R;XA)
Law at Malaysia act A250. Radioactive substances (amendment) act 1974, 15:4892 (R;MY)
Management of spent fuel from research and prototype power reactors and residues from post-irradiation examination of fuel. Proceedings of a technical committee meeting held in Vienna, 28 November - 1 December 1988, 15:4759 (R;XA)
Nuclear electronics laboratory manual 1989 edition, 15:5741 (R;XA)
RCA annual report 1988, 15:6463 (R;XA)
Research using small tokamaks. Proceedings of a technical committee meeting held in Nice, France, 10-11 October 1988, 15:6295 (R;XA)
Status of advanced technology and design for water cooled reactors: Heavy water reactors, 15:5101 (R;XA)
Survey of ranges of component reliability data for use in probabilistic safety assessment, 15:5185 (R;XA)
Technical and economic benefits of nuclear techniques in ore processing. Report of an advisory group meeting held in Krakow, Poland, 24-28 October 1988, 15:5544 (R;XA)

International Atomic Energy Agency, Vienna (Austria). International Nuclear Data Committee
Fusion Evaluated Nuclear Data Library (FENDL). Proceedings of the IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation, Vienna, 8-11 May 1989. Summary report, 15:6363 (R;XA)
Plans for use of ENDF/B in reactor research in Indonesia: Paper presented in the second Asian Symposium on Research Reactors (ASRR-II) held at Serpong, Indonesia 23-25 May 1989, 15:5116 (R;XA)
Translation of selected papers published in Nuclear Constants 1, 1987, 15:6103 (R;XA)

International Atomic Energy Agency, Vienna (Austria). International Working Group on Gas-Cooled Reactors
Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988, 15:5078 (R;XA)

International Atomic Energy Agency, Vienna (Austria). International Working Group on Water Reactor Fuel Performance and Technology
Water reactor fuel element computer modelling in steady state, transient and accident conditions. Proceedings of a technical committee meeting held in Preston, 18-22 September 1988, 15:5129 (R;XA)

International Bank for Reconstruction and Development, Washington, DC (USA). Economic Development Inst.
People and trees: The role of social forestry in sustainable development. Seminar series, 15:5251 (R;US)

International Centre for Theoretical Physics, Trieste (Italy)
A comparison of void distributions in Abell cluster catalogue with numerical simulations, 15:5996 (R;XA)
A generalised Virasoro algebra for the Type IIA superstring, 15:6083 (R;XA)
A lattice gas model for enzyme kinetics (A correlated walks theory and variational procedures), 15:6247 (R;XA)
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Nonlinear interaction of electrostatic waves at a narrow inhomogeneous layer of a warm magnetoactive plasma, 15:6317 (R;XA)
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The Einstein A-coefficient of spontaneous emission: A relativistic calculation in the Heisenberg representation, 15:6251 (R;XA)
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Universal moduli space and string theory, 15:6261 (R;XA)
Void distributions in ACO cluster catalogue, 15:5995 (R;XA)
What influences order parameters across the superconducting phase boundary?, 15:6242 (R;XA)

International Solar Energy Society (ISES), Rome (Italy). Italian Section
Bioclimatic architecture, energy conservation and environmental quality. Prospectives and applications in the design and construction of public buildings and schools. Proceeding of the ISES meeting held in Rome (Italy), 9-10 November 1988, 15:4936 (R;IT;In Italian)

InterScience, Inc., Troy, NY (USA)
Magnetic mirror confinement concepts system studies: Final report, 15:6290 (R;US)

Iowa Univ., Iowa City, IA (USA)
Determination of stepsize parameters for intermolecular vibrational energy transfer: Progress report for the period May 1, 1988–April 30, 1989, 15:6022 (R;US)

Iowa Univ., Iowa City, IA (USA). Dept. of Physics and Astronomy
Relativistic electrons in Saturn's inner magnetosphere and an estimate of their synchrotron emission. Progress report, 15:5977 (R;US)

Istituto Nazionale di Fisica Nucleare, Rome (Italy)
Coulombic potential in the strong coupling limit of compact QED with quasiperiodic boundary conditions, 15:6091 (R;IT)
Noncompact formulation of abelian gauge theories in lattice and charge quantization, 15:6092 (R;IT)
RF test of a 6 GHz superconducting cavity at LNF, 15:5720 (R;IT)
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J

JBF Associates, Knoxville, TN (USA)
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Joint Inst. for Nuclear Research, Dubna (USSR)
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Low-energy predictions of modern chiral lagrangians based on quark dynamics: Lectures for young scientists, 15:6064 (R;SU;In Russian)
Spectrometric circuit for MIS-2 installation silicon target, 15:5769 (R;SU;In Russian)

Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation
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Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems
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Microwave radiation absorption by Ho(Y)-Ba-Cu-O superconducting ceramics, 15:6244 (R;SU;In Russian)

Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions
High resolution laser-atomic beam spectroscopy in Gdl, 15:6032 (R;SU;In Russian)

Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics
Integration method of the Korteweg-de Vries equation with a self consistent source, 15:6275 (R;SU;In Russian)
Properties of the cross section of small-angle scattering on anisotropic bodies, 15:6231 (R;SU;In Russian)
Renormalization group in statistical physics - momentum and real spaces, 15:6095 (R;SU;In Russian)
The application of the method of boson variable elimination to the analysis of evolution of some systems interacting with boson fields, 15:6281 (R;SU;In Russian)
The Bethe anzatz for rotated boundary conditions, 15:6282 (R;SU;In Russian)

K

K.T. Analytics, Inc., Frederick, MD (USA)
Assessment of travel-demand approaches at suburban activity centers. Final report, October 1988-April 1989, 15:5348 (R;US)

Kaiser Engineers (California) Corp., Oakland, CA (USA)
Conceptual system design description: Nuclear Waste Repository in Basalt, Project B-301: Volume 2, 15:4822 (R;US)
Task V, engineering study No. 5: Shaft optimization, 15:4817 (R;US)

Kansas State Univ., Manhattan, KS (USA). Dept. of Chemistry
Hadamard transform spectrometry: A new analytical technique: Progress report, 15:5794 (R;US)

Karlsruhe Univ. (T.H.) (Germany, F.R.). Fakultaet fuer Maschinenbau
Benard convection in liquid sodium layers, 15:5656 (R;DE;In German)

Kent State Univ., OH (USA). Dept. of Physics
Theoretical interpretation of data from high-energy nuclear collisions: Progress report, January 1, 1989–September 30, 1989, 15:6157 (R;US)

Kentucky Univ., Lexington, KY (USA). Dept. of Mechanical Engineering
Determination of local radiative properties in coal-fired flames: Technical progress report, September 15, 1988–September 15, 1989, 15:4642 (R;US)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Festkoerperforschung
Electrons on the sphere in the magnetic-monopole field. A study of the Green function in the white-noise potential, 15:6283 (R;DE;In German)

Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Sicherheitsforschung
Kinetics of the graphite/oxygen reaction in the in-pore diffusion controlled regime. Pt. 3. Influence of boundary layer diffusion in kinetic experiments at temperatures 970 K - 1170 K, 15:5515 (R;DE;In German)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Material- und Festkoerperforschung
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Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Meteorologie und Klimaforschung
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Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Entsorgungstechnik
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Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente
Benard convection in liquid sodium layers, 15:5656 (R;DE;In German)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Technische Physik
Numerical calculation of current leads for fusion magnets, 15:6367 (R;DE)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Kernfusion
Numerical calculation of current leads for fusion magnets, 15:6367 (R;DE)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter
Benard convection in liquid sodium layers, 15:5656 (R;DE;In German)

Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung
24 h-corrosion tests combined with electrochemical potential measurements of CrNi-steel DIN W.Nr. 1.4306 (AISI Type 304 L) in 7 molar nitric acid containing oxidizing metal ions at 90deg C, 15:5443 (R;DE;In German)
Electron microscopy of phase and microstructure development in aluminum silicate ceramics for the immobilization of transuranium element containing wastes, 15:5501 (R;DE;In German)
Standard and applied material testing methods of austenitic CrNi stainless steels in different nitric acid media - procedures and results, 15:5665 (R;DE)

Koeln Univ. (Germany, F.R.)
Electrons on the sphere in the magnetic-monopole field. A study of the Green function in the white-noise potential, 15:6283 (R;DE;In German)

Komitet za Mirno Izpolzuvane na Atomnata Energiya, Sofia (Bulgaria)
Development of a personal computer based facility-level SSAC component and inspector support system. Final report for the period 1 January 1987 - 30 June 1989, 15:4887 (R;XA)

KRW Energy Systems, Inc., Madison, PA (USA)
A 50-month gasifier mechanistic study and downstream unit process development program for the pressurized ash-agglomerating fluidized-bed gasification system: Volume 1: Final report, August 1984–September 1988, 15:4560 (R;US)
A 50-month gasifier mechanistic study and downstream unit process development program for the pressurized ash-agglomerating fluidized-bed gasification system: Volume 2: Final report, August 1984–September 1988, 15:4561 (R;US)

L

La Plata Univ. Nacional (Argentina). Dept. de Fisica
- Point defects dynamics in a stress field: Application to hexagonal close packed metals, 15:6219 (R;AR;In Spanish)

Lawrence Berkeley Lab., CA (USA)
- A superwindow field demonstration program in northwest Montana, 15:5324 (R;US)
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- Conservation potential of compact fluorescent lamps in India and Brazil, 15:5326 (R;US)
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- Evaluation of technology for detection of anomalies during repository excavation at the BWIP [Basalt Waste Isolation Project] site: Report on Subtask 3F–Excavation instrument development of Lawrence Berkeley Laboratories Interagency Assistance to the Basalt Waste Isolation Project, 15:4854 (R;US)
- Fenestration performance analysis using an interactive graphics-based methodology on a microcomputer, 15:5325 (R;US)
- Isothermal fatigue behavior of Sn–Pb solder joints, 15:5448 (R;US)
- Materials and Chemical Sciences Division annual report, 1988, 15:5403 (R;US)
- Name assignment techniques for relational schemas representing extended entity-relationship schemas, 15:6492 (R;US)
- Optimizing and evaluating algorithms for replicated data concurrency control, 15:6479 (R;US)
- Physics with nuclei at high energies, 15:6174 (R;US)
- Regional electricity supply and consumption in developing countries, 1980–1986: Database report: Draft, 15:5284 (R;US)
- Semi-analytical solutions for flow problems in unsaturated porous media, 15:4791 (R;US)
- Superconducting magnets in space, 15:5689 (R;US)
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- The applicability of expert systems to risk analysis for waste disposal problems, 15:4790 (R;US)
- Workshop proceeding of the industrial building energy use, 15:5327 (R;US)
- X-ray microimaging for the life sciences, 15:5798 (R;US)

Lawrence Livermore National Lab., CA (USA)
- A comparison of spatial averaging and Cadzow's method for array wavenumber estimation, 15:5973 (R;US)
- A constitutive theory for stress wave propagation across closed fluid-filled rough fractures, 15:4870 (R;US)
- A future for LLNL [Lawrence Livermore National Laboratory] research in composite high explosives, 15:5805 (R;US)
- A review of Inertial Confinement Fusion (ICF), ICF reactors, and the HYLIFE-II concept using liquid FLiBe, 15:6371 (R;US)
- A simple shell element formulation for large-scale elastoplastic analysis, 15:5645 (R;US)
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- Astophysical opacities at LLNL, 15:6002 (R;US)
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- Greenhouse gases: Changing the global climate, 15:5842 (R;US)
- Innovative design concepts for the LMF target chamber and related systems: Final report, April 1988–March 1989, 15:6329 (R;US)
- Integration of a gated microchannel plate detector into the Nova laser system, 15:5784 (R;US)
- Intense REB [relativistic electron beam] transport in a weakly magnetized plasma, 15:6330 (R;US)
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- Prototype Engineered Barrier System Field Tests: Progress report, 15:4869 (R;US)
- Rayleigh-Taylor instability in compressible fluids: Final report, 1 October 1988–30 September 1989, 15:5657 (R;US)
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- Site safety plan for Site 300 environmental restoration, 15:5881 (R;US)
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- Using the gain spectrum to determine the beam distribution in the LLNL 5M Paladin experiment, 15:5678 (R;US)

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YB_{66}: A new soft x-ray monochromator for synchrotron radiation, 15:5785 (R;US)

Leadbetter (A.C.) and Son, Inc., Toledo, OH (USA)
Development of an advanced gas-fired mineral-wool melter. Annual report, January-December 1988, 15:4735 (R;US)

Lexicon Project Committee, Fredericton, NB (Canada)
Glossary of heating techniques, 15:5328 (R;CA)

Ljubljana Univ., Piran (Yugoslavia). Marine Biological Station
Chemical and isotopic composition of marine organic matter as indicators of its origin. Final report for the period 15 December 1987 - 14 December 1988, 15:5895 (R;XA)

Los Alamos National Lab., NM (USA)
A brief description of lattice gas models for multiphase flows and magnetohydrodynamics, 15:6046 (R;US)
A hypervelocity projectile launcher for well perforation, 15:4683 (R;US)
A hypervelocity projectile launcher for well perforation, 15:4684 (R;US)
A passive-active neutron device for assaying remote-handled transuranic waste, 15:4789 (R;US)
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Uniform versus random sampling in physical calculations: Monte Carlo, 15:6478 (R;US)

Lotus Consulting, Los Altos, CA (USA)
Empirical analysis of electricity wheeling in Illinois, 15:5281 (R;US)

Louisiana Gasification Technology, Inc., Plaquemine, LA (USA)
Environmental Monitoring Plan for the Dow Syngas Project. Annual Health and Safety Report, 1988. Report for 1 April 1988-31 March 1989, 15:4578 (R;US)

Lund Univ. (Sweden). Dept. of Cosmic and Subatomic Physics
On the observation of a transition from fusion to multifragmentation in high multiplicity ^{16}O induced reactions, 15:6124 (R;SE)

Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire
Two-photon transition intensities for Sm^{2+} In BaClF, 15:6034 (R;FR)

M

Maritime Marine Consultants Ltd., Rothesay, NB (Canada)
Pro-fisher seminars, 15:5373 (R;CA)

Massachusetts Inst. of Tech., Cambridge, MA (USA)
Interfacial systems for photochemical energy conversion: Progress report, December 1, 1988–November 30, 1989, 15:5565 (R;US)
Physically based network model for two- and three-phase saturation: Capillary pressure relationships. Final report, 15:5362 (R;US)

Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Mechanical Engineering
Brittle to ductile transition in cleavage fracture: [Year-end progress report], 15:5424 (R;US)

Materials Engineering Associates, Inc., Lanham, MD (USA)
Fracture toughness characterization of nuclear piping steels, 15:5123 (R;US)
Slow strain rate testing of a cyclically stabilized A 516 Gr. 70 piping steel in PWR conditions, 15:5070 (R;US)

Materials Properties Council, Inc., New York, NY (USA)
Dissimilar-weld failure analysis and development program: Volume 8, Design and procedure guide for improved welds: Final report, 15:4978 (R;US)

Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik
Studies of single superconducting grains for a neutrino and dark matter detector, 15:5771 (R;DE)
The possibility to measure the time dependence of B_s^0 - anti B_s^0 oscillations using Fourier analysis, 15:5772 (R;DE)

Max-Planck-Institut fuer Plasmaphysik, Garching (Germany, F.R.)
A fast numerical algorithmus for thermographic diagnostics, 15:6318 (R;DE)
Characterizing the edge plasma of different ohmic confinement regimes in ASDEX, 15:6319 (R;DE)
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Entropy relaxation of ASDEX plasmas, 15:6321 (R;DE)
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On vacuum field properties of the URAGAN-2M Torsatron standard configuration, 15:6320 (R;DE)
The H-mode of ASDEX, 15:6324 (R;DE)

Meridian Corp., Alexandria, VA (USA)
Summary of the planning, management, and evaluation process for the Geothermal Program Review VI conference, 15:4962 (R;US)

Merlewood Research Station, Grange-over-Sands (UK). Inst. of Terrestrial Ecology
Post Chernobyl studies. Final report MAFF/NERC contract, 15:5194 (R;GB)

Minas Gerais Univ., Belo Horizonte, MG (Brazil)
Contribution to the study of the evolution of nuclear fuel composition in PWR type reactors. Reactor cores in three and four regions of enrichment, 15:5020 (R;BR;In Portuguese)

Mine Safety and Health Administration, Arlington, VA (USA)
Coal-surface fatalities. Second half-1988. Abstracts with illustrations. Analysis and suggested uses, 15:4667 (R;US)
Coal-underground fatalities. Second half-1988. Abstracts with illustrations. Analysis and suggested uses, 15:4666 (R;US)

Mine Safety and Health Administration, Denver, CO (USA)
A coal mine ventilation survey method, 15:4636 (R;US)
Annual report of the secretary of labor under the Federal Mine Safety and Health Act of 1977: Fiscal year 1982, 15:4664 (R;US)
Injury experience in coal mining, 1986, 15:4653 (R;US)
Injury experience in metallic mineral mining, 1987, 15:4659 (R;US)
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Injury experience in sand and gravel mining, 1986, 15:4657 (R;US)
Injury experience in stone mining, 1986, 15:4656 (R;US)
Respirable coal mine dust sample processing, 15:4635 (R;US)

Mine Safety and Health Administration, Denver, CO (USA). Safety and Health Technology Center
A comparison of dust data from 29 select underground coal mines 1968–1986, 15:4637 (R;US)
Annual report of the secretary of labor under the federal mine safety and health act of 1977: Fiscal year 1987, 15:4665 (R;US)
Injury experience in coal mining, 1987, 15:4658 (R;US)
Injury experience in metallic mineral mining, 1986, 15:4654 (R;US)
Injury experience in nonmetallic mineral mining (Except stone and coal), 1986, 15:4655 (R;US)
Injury experience in nonmetallic mineral mining (except stone and coal), 1987, 15:4660 (R;US)
Injury experience in nonmetallic mineral mining (except stone and coal), 1988, 15:4663 (R;US)
Injury experience in stone mining, 1987, 15:4661 (R;US)

Minerals Management Service, Anchorage, AK (USA). Alaska Outer Continental Shelf Region
Geological and operational summary, North Aleutian Shelf Coast No. 1 well, Bering Sea, Alaska. Final report, 15:4680 (R;US)

Minerals Management Service, Metairie, LA (USA). Gulf of Mexico OCS Regional Office
Gulf of Mexico sales 123 and 125: Central and western planning areas. Draft environmental impact statement, 15:4701 (R;US)
Gulf of Mexico sales 123 and 125: Central and western planning areas. Final environmental impact statement, 15:4702 (R;US)

Minnesota Univ., St. Paul, MN (USA)
High-temperature superconducting compounds. Technical report, 1 September 1987-28 February 1989, 15:5471 (R;US)

Mission Research Corp., Los Alamos, NM (USA)
Theoretical and computational studies of magnetic insulation and other plasma-opening-switch phenomena, 15:6370 (R;US)

Missouri Univ., Rolla, MO (USA). Dept. of Mechanical and Aerospace Engineering
Phase-change material for spacecraft thermal management. Interim report, 15 March 1987-31 March 1988, 15:5220 (R;US)

Mitre Corp., McLean, VA (USA). METREK Div.
Task force report on health effects assessment, 15:5923 (R;US)

Montana Bureau of Mines and Geology, Butte, MT (USA)
Precambrian and Mesozoic plate margins: Montana, Idaho and Wyoming with field guides for the 8th international conference on basement tectonics, 15:5966 (R;US)

Mountain Association for Community Economic Development, Inc., Berea, KY (USA)
Transfer of advanced manufacturing technologies to eastern Kentucky industries, 15:5259 (R;US)

MSE, Inc., Butte, MT (USA)
[Manage, operate and maintain the component development and integration facility in Butte, MT]: Quarterly technical progress report, July 1–September 30, 1989, 15:5287 (R;US)

N

National Accelerator Centre, Faure (South Africa)
Effects of various filters on a p(66 MeV)/Be neutron beam, 15:5924 (R;ZA)

National Aeronautical Establishment, Ottawa, ON (Canada)
Processing of advanced ceramics which have potential for use in gas turbine aero engines, 15:5520 (R;CA)

National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center
Experience with advanced instrumentation in a hot section cascade, 15:5674 (R;US)
Indium phosphide solar cell research in the US: Comparison with nonphotovoltaic sources, 15:4930 (R;US)

National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center
Commentary on interstellar matter associated with 18 open clusters, 15:6001 (R;US)

National Aeronautics and Space Administration, Houston, TX (USA). Lyndon B. Johnson Space Center
A tandem mirror hybrid plume plasma propulsion facility, 15:6333 (B;US)

National Aeronautics and Space Administration, Washington, DC (USA)
Solar physics in the space age, 15:6000 (R;US)

National Center for Atmospheric Research, Boulder, CO (USA)
Global distribution of total cloud cover and cloud type amounts over the ocean, 15:5822 (R;US)

National Inst. for Occupational Safety and Health, Atlanta, GA (USA)
Testimony of James M. Melius, M.D., on the reproductive health of workers using video-display terminals before the Subcommittee on Health and Safety Committee on Education and Labor. United States House of Representatives, June 4, 1986, 15:5962 (R;US)

National Inst. for Occupational Safety and Health, Cincinnati, OH (USA)
NIOSH (National Institute for Occupational Safety and Health) testimony to Subcommittee on Manpower, Compensation, and Health and Safety, House Committee on Education and Labor by Dr. John F. Finklea, October 7, 1975, 15:4668 (R;US)
NIOSH (National Institute for Occupational Safety and Health) testimony to Subcommittee on Energy Research, Development and Demonstration, House Committee on Science and Technology by Dr. John F. Finklea, February 11, 1976, 15:4669 (R;US)

National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)
Development of technology for entrainer-enhanced CO_2 flooding: Status report, 15:4686 (R;US)
Methods for assessing the stability and compatibility of residual fuel oils: Final report, 15:4708 (R;US)
Thermal processes for heavy oil recovery: Status report, 15:4685 (R;US)

National Inst. of Radiation Protection, Stockholm (Sweden)
Activity report 1 jan 1987 - 30 jun 1988. Swedish National Institute of Radiation Protection Research department (Main division of Research and Development), 15:6216 (R;SE;In Swedish)
Ambulating radiography, 15:6217 (R;SE;In Swedish)

National Inst. of Standards and Technology (NEL), Gaithersburg, MD (USA). Center for Building Technology
Air-quality investigation in the NIH (National Institutes of Health) Radiation Oncology Branch, 15:5840 (R;US)

National Inst. of Standards and Technology, Gaithersburg, MD (USA)
Determination of trace-level iodine in biological and botanical reference materials by isotope-dilution mass spectrometry, 15:5553 (R;US)

National Inst. of Standards and Technology, Gaithersburg, MD (USA). Surface Science Div.
Structure and reactivity of chemisorbed species and reaction intermediates: Final report, December 1, 1981–December 4, 1989, 15:5422 (R;US)

National Ocean Service, Anchorage, AK (USA). Ocean Assessments Div.
Outer continental shelf environmental assessment program. Final reports of principal investors. Volume 62, 15:4681 (R;US)

National Physical Lab., Teddington (UK)
NPL contribution to a EURADOS Working Committee 4 intercomparison of unfolding codes for Bonner sphere data, 15:5773 (R;GB)

National Research Council of Canada, Boucherville, PQ (Canada). Industrial Materials Research Inst.
Automation of pipe welding using machine vision and adaptive control, 15:5451 (R;CA)

National Research Council of Canada, Ottawa, ON (Canada)
Proceedings [of the] symposium on the aerial application of pesticides in forestry, 15:5929 (R;CA)
Window performance and new technology. Proceedings of Building science insight '88, 15:5329 (R;CA)
Window performance and new technology. Proceedings of Building science insight '88, 15:5334 (R;CA;In French)

National Research Council of Canada, Ottawa, ON (Canada). Associate Committee on Propulsion
Proceedings [of the] seventh NRCC [National Research Council of Canada] symposium on industrial application of gas turbines, 15:5637 (R;CA)

National Research Council, Washington, DC (USA). Commission on Engineering and Technical Systems
Intelligent process control systems for materials heat treatment, 15:5355 (R;US)

National Technical Information Service, Springfield, VA (USA)
Chemical and biological warfare: Biology, chemistry, and toxicology. May 1988-October 1989 (Citations from the NTIS data base). Report for May 1988-October 1989, 15:5603 (R;US)
Chemical and biological warfare: Protection, decontamination, and disposal. January 1979-October 1989 (Citations from the NTIS data base). Report for January 1979-October 1989, 15:5641 (R;US)
Coal desulfurization. January 1970-August 1989 (Citations from the COMPENDEX data base). Report for January 1970-August 1989, 15:4556 (R;US)
Corrosion-resistant coatings. April 1988-September 1989 (Citations from the International Aerospace Abstracts data base). Report for April 1988-September 1989, 15:5454 (R;US)
Corrosion-resistant coatings. January 1974-March 1988 (Citations from the International Aerospace Abstracts data base). Report for January 1974-March 1988, 15:5453 (R;US)
Defense Waste Processing facility (DWPF): The vitrification of high-level nuclear waste. January 1980-September 1989 (Citations from the NTIS database). Report for January 1980-September 1989, 15:4799 (R;US)
Ground water: Isostope tracing. January 1977-July 1989 (Citations from the Selected Water Resources Abstracts data base). Report for January 1977-July 1989, 15:5900 (R;US)
Liquid membranes. January 1970-August 1989 (Citations from the COMPENDEX data base). Report for January 1970-August 1989, 15:5555 (R;US)
Microwave heating: Industrial applications. September 1986-September 1989 (Citations from the COMPENDEX data base). Report for September 1986-September 1989, 15:5365 (R;US)
Nickel-cadmium batteries. January 1977-October 1989 (Citations from the NTIS data base). Report for January 1977-October 1989, 15:5229 (R;US)
Pipeline-system insulation: Thermal insulation and corrosion prevention. December 1985-September 1989 (Citations from the Rubber and Plastics Research Association data base). Report for December 1985-September 1989, 15:5349 (R;US)
Sulfur dioxide control: Sulfur dioxide from coal-burning sources. May 1986-September 1989 (Citations from the NTIS database). Report for May 1986-September 1989, 15:4596 (R;US)
Terrorism. January 1970-September 1989 (Citations from the NTIS data base). Report for January 1970-September 1989, 15:5806 (R;US)
Toxicity of nickel. February 1970-September 1989 (Citations from the NTIS data base). Report for February 1970-September 1989, 15:5956 (R;US)
Windmill design, development, construction, and performance. November 1982-September 1988 (Citations from Fluidex data base). Report for November 1982-September 1988, 15:4972 (R;US)
Windmill design, development, construction, and performance. October 1988-October 1989 (Citations from Fluidex data base). Report for October 1988-October 1989, 15:4973 (R;US)

National Wetlands Research Center, Slidell, LA (USA)
Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic): Atlantic marsh fiddler, 15:5847 (R;US)

Naval Ocean Systems Center, San Diego, CA (USA)
Energetic electron-induced impurity ionization in Si:As IBC detectors, 15:5788 (R;US)

Naval Postgraduate School, Monterey, CA (USA)
NATO (North Atlantic Treaty Organization) deterrence and defense after the INF (Intermediate-Range Nuclear Forces) treaty. Final report, June 1988-June 1989, 15:5397 (R;US)

Naval Research Lab., Washington, DC (USA)
Superconducting-switch program. Final interim report, January 1987-April 1988, 15:5620 (R;US)

NCT Engineering, Inc., Lafayette, CA (USA)
Component fragility research program: Phase 2, Development of seismic fragilities from high-level qualification data, 15:5206 (R;US)

Nevada Univ., Reno, NV (USA)
[High temperature chemistry of aromatic hydrocarbons]: Progress report, 15:5566 (R;US)

New Brunswick Univ., Fredericton, NB (Canada). Dept. of Mechanical Engineering
Tank thermal response analysis, phase 2: A study of the transient phenomena in a heated vessel during depressurization, 15:5635 (R;CA)

New Energy Development Organization, Tokyo (Japan)
Feasibility study on superconducting technology for geothermal resources exploration, 15:4960 (R;JP;In Japanese)
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Review of methods for long term monitoring of the environmental effects of geothermal development (Soil and vegetation). I Main subject. II Collection of data sheets, 15:4958 (R;JP;In Japanese)
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New Orleans Univ., LA (USA). Dept. of Chemistry
Computational approaches to the identification of suspect toxic molecules, 15:5955 (R;US)

Newfoundland Dept. of Energy, St. John's, NF (Canada)
Hydrocarbon potential of the western Newfoundland offshore area, 15:4679 (R;CA)

Nordisk Kontaktorgan for Atomenergispoergsmaal, Risoe (Denmark)
Nordic projects in the field of nuclear safety. Annual report 1987, 15:6465 (R;DK;In Danish, Norwegian, Swedish)

Norsk Inst. for Luftforskning, Lillestroem (Norway)
Measurement of radioactivity in Norway: Annual report 1987, 15:6215 (R;NO;In Norwegian)

North Carolina Cooperative Fishery Research Unit, Raleigh, NC (USA)
Species profiles: Life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic): Atlantic marsh fiddler, 15:5847 (R;US)

North Carolina Univ., Chapel Hill, NC (USA). Dept. of Chemistry
Chemical approaches to artificial photosynthesis, 15:4927 (R;US)
Energy conversion at the molecular level, 15:5561 (R;US)

North Carolina Univ., Chapel Hill, NC (USA). William R. Kenan, Jr. Labs. of Chemistry
[Solid state voltammetry and sensors in solids and gases]: Progress report, April 1, 1989–March 31, 1990, 15:5228 (R;US)

North Central Texas Council of Governments, Arlington, TX (USA)
Dallas area rapid-transit-service privatization: A summary of benefits/risks for transit providers, 15:5347 (R;US)

North Dakota Univ., Grand Forks, ND (USA). Energy and Mineral Research Center
Flue gas conditioning for fabric filter performance improvement: Quarterly technical progress report, July–September 1989, 15:4982 (R;US)

Northrop Services, Inc., Ada, OK (USA)
Analysis of volatile organic chemicals in aqueous samples by purge/GC (gas chromatography) with selective water removal, 15:5554 (R;US)

Northwest Territories Dept. of Renewable Resources, Yellowknife, NT (Canada)
An evaluation of the Norman Wells project, 15:5241 (R;CA)

Nuclear Energy Agency, 75 - Paris (France)
Design requirements, operation and maintenance of gas-cooled reactors. Proceedings of a technical committee meeting held in San Diego, 21-23 September 1988, 15:5078 (R;XA)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering
BWR reactor water cleanup system flexible wedge gate isolation valve qualification and high energy flow interruption test: Data report, 15:5006 (R;US)
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Slow strain rate testing of a cyclically stabilized A 516 Gr. 70 piping steel in PWR conditions, 15:5070 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Freedom of Information and Publications Services
NRC [Nuclear Regulatory Commission] editorial style guide, 15:6493 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Low-Level Waste Management and Decommissioning
User's manual for the MIGRAT pre- and postprocessor, 15:4794 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Regulatory Applications
Performance of the liquid reactivity control system in BWRs [boiling water reactors], 15:5150 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Issue Resolution
Multiple system responses program: Identification of concerns related to a number of specific regulatory issues, 15:5205 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research
Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR): User's guide: Part 1, Overview of NUCLARR data retrieval, 15:5198 (R;US)
Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR): User's guide: Part 2, Guide to operations, 15:5199 (R;US)
Nuclear Computerized Library for Assessing Reactor Reliability (NUCLARR): User's guide: Part 3, NUCLARR system description, Revision 1, 15:5200 (R;US)
Validation of risk-based performance indicators: Safety system function trends, 15:5201 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data
Licensee Event Report (LER) compilation for month of September 1989: Volume 8, No. 9, 15:5197 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation
Integrated plant safety assessment, Systematic Evaluation Program: Dresden Nuclear Power Station, Unit 2 (Docket No. 50-237): Final report, 15:5196 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research
BWR reactor water cleanup system flexible wedge gate isolation valve qualification and high energy flow interruption test: Review of issues associated with BWR containment isolation valve closure: Volume 3, 15:5204 (R;US)

Nuclear Regulatory Commission, Washington, DC (USA). Office of the General Counsel
United States Nuclear Regulatory Commission Staff practice and procedure digest: Commission, Appeal Board and Licensing Board Decisions, July 1972–December 1988: Revision 2, 15:5106 (R;US)

NUCLEBRAS, Belem, PA (Brazil). Superintendencia Geral de Prospeccao e Pesquisa Mineral
Geochemical behaviour of U_3O_8, Mo, Y, Ga, V and Zr in laterite - bauxitic sequence of the "Croanta-Paragominas", 15:4750 (R;BR;In Portuguese)
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[Coal liquefaction and materials]: Foreign trip report, October 29–November 2, 1989, 15:4577 (R;US)
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[Crybiology facilities]: Foreign trip report, October 25–November 7, 1989, 15:5907 (R;US)
[Diffuse x-ray data on Ni-Cr solid solutions]: Foreign trip report, September 30, 1989–October 21, 1989, 15:5452 (R;US)
[Global energy development]: Foreign trip report, October 7–October 21, 1989, 15:5233 (R;US)
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[Heavy-section steel irradiation program]: Foreign trip report, October 21, 1989–November 11, 1989, 15:5124 (R;US)
[Intermediate voltage electron microscope]: Foreign trip report, November 7–12, 1989, 15:5776 (R;US)
[Long-range transboundary air pollution]: Foreign trip report, November 2–13, 1989, 15:5837 (R;US)
[Man-machine interface of computer controlled reactors]: Foreign trip report, October 16, 1989–October 22, 1989, 15:5103 (R;US)
[Multiconfigurational Dirac - Fock calculations of ionization potentials of unnilquadium and hafnium (2+)]: Foreign trip report, October 23–November 1, 1989, 15:6035 (R;US)
[Nitrogen deposition to forest trees]: Foreign trip report, September 30, 1989–October 13, 1989, 15:5835 (R;US)
[Nuclear level densities]: Foreign trip report, November 12–November 20, 1989, 15:6175 (R;US)
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[Workshop on nuclear physics with large arrays]: Foreign trip report, October 30–November 13, 1989, 15:5777 (R;US)
[Workshop on nuclear structure in the era of new spectroscopy]: Foreign trip report, October 2–October 28, 1989, 15:5774 (R;US)

Ohio State Univ., Columbus, OH (USA). Dept. of Chemistry
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Oklahoma Univ., Norman, OK (USA). Dept. of Botany and Microbiology
Effect of community structure on the kinetics of anaerobic degradation of aromatic compounds: Progress report, March 1989–November 1989, 15:5903 (R;US)

Old Dominion Univ., Norfolk, VA (USA)
Theoretical studies of solar lasers and converters. Progress report 15 May-31 December 1988, 15:5690 (R;US)

Ontario Ministry of the Environment, Toronto, ON (Canada). Water Resources Branch
In-place pollutants programs: Volume 2. Background and theoretical concepts, 15:5899 (R;CA)
The in-place pollutants program: Volume 3. Phase 1 studies, 15:5898 (R;CA)
The in-place pollutants program: A program overview: Volume 1, 15:5897 (R;CA)

Ontario Research Foundation, Sheridan Park, ON (Canada)
Proceedings of the third Windsor workshop on alternative fuels, 15:5389 (R;CA)

Oregon Inst. of Tech., Klamath Falls, OR (USA)
Geothermal district piping - A primer, 15:4965 (R;US)

Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center
Klamath Falls geothermal field, Oregon: Case history of assessment, development and utilization, 15:4964 (R;US)

Oregon State Univ., Corvallis, OR (USA). Dept. of Microbiology
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Oregon Univ., Eugene, OR (USA). Inst. of Theoretical Science
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Oslo Univ. (Norway). Fysisk Inst.
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Ostgren Associates, Inc., San Francisco, CA (USA)
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Pacific Northwest Lab., Richland, WA (USA)
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Para Univ., Belem, PA (Brazil). Centro de Geociencias
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Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire
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Patuxent Wildlife Research Center, Laurel, MD (USA)
Molybdenum hazards to fish, wildlife, and invertebrates: A synoptic review, 15:5953 (R;US)

Pearson (D.E.) and Associates Ltd., Victoria, BC (Canada)
Petrographic characterization of treated and untreated coals: Final report, 15:4588 (R;CA)

Pennsylvania State Univ., University Park, PA (USA). Coll. of Earth and Mineral Sciences
Thermal stability of jet fuel: Fourth quarterly report, July–September 1989, 15:4707 (R;US)

Pennsylvania State Univ., University Park, PA (USA). Dept. of Chemistry
Studies of the formation chemical reactivity and properties of small clusters: Application to an understanding of aerosol formation and heterogeneous chemistry, 15:5567 (R;US)

Petro-Canada Products, Sheridan Park, ON (Canada). Research and Development Centre
Petro-Canada annual report, 15:4697 (R;CA)

Petroleum Monitoring Agency, Ottawa, ON (Canada)
Canadian petroleum industry, 1988 monitoring report, 15:4698 (R;CA)

Pittsburgh Univ., PA (USA). Dept. of Physics and Astronomy
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Princeton Univ., NJ (USA)
Current driven instabilities of an electromagnetically accelerated plasma, 15:6332 (B;US)

Princeton Univ., NJ (USA). Dept. of Mechanical and Aerospace Engineering
Experimental and computational study of combustion limits in natural-gas-fueled internal combustion engines. Annual report, May 1988-April 1989, 15:5394 (R;US)

Princeton Univ., NJ (USA). Plasma Physics Lab.
Heating the Compact Ignition Tokamak (CIT), 15:6327 (R;US)

Purdue Univ., Lafayette, IN (USA). School of Chemical Engineering
Gas-liquid-liquid equilibria in mixtures of water, light gases, and hydrocarbons: Progress report, December 1, 1988–November 30, 1989, 15:5562 (R;US)
Macromolecular coal structure as revealed by novel diffusion tests: Annual technical report, September 15, 1988–September 14, 1989, 15:4585 (R;US)

Purdue Univ., Lafayette, IN (USA). Water Resources Research Center
Measurement of recharge rates through an unsaturated glacial till by tritium analyses. Technical report, 1 July 1988-30 June 1989 (Final), 15:5972 (R;US)

Q

Quebec Agricultural Economic Reference Committee, Laval, PQ (Canada)
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Quebec Ministere de l'Agriculture, des Pecheries et de l'Aminentation, Ste-Foy, PQ (Canada)
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Queen's Univ., Kingston, ON (Canada). Canadian Inst. of Guided Ground Transport
Low-friction snow plow evaluation, 15:5350 (R;CA)

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Radian Corp., Sacramento, CA (USA)
Feasibility and cost-effectiveness of controlling emissions from diesel engines in rail, marine, construction, farm, and other mobile off-highway equipment. Final report, 15:5385 (R;US)

RAND Corp., Santa Monica, CA (USA)
Strategic defenses and crisis stability. Interim report, 15:5402 (R;US)

RDP, Inc., Waltham, MA (USA)
TEC (total electron content) models. Report for 3 February 1988-2 February 1989, 15:6012 (R;US)

Recycling Advisory Committee, Hamilton, ON (Canada)
A recycling strategy for Ontario: Discussion paper, 15:5268 (R;CA)

Reid Crowther and Partners Ltd., Winnipeg, MB (Canada)
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Rensselaer Polytechnic Inst., Troy, NY (USA)
Hydrogen radical enhanced growth of solar cells: Phase 1 annual report, June 1, 1987–March 31, 1989, 15:5457 (R;US)

Rensselaer Polytechnic Inst., Troy, NY (USA). High-Temperature Reaction Kinetics Lab.
Kinetic measurements on elementary fossil fuel combustion reactions over wide temperature ranges: Progress report, December 1, 1986–October 31, 1989, 15:5617 (R;US)

Research Inst. of the Gulf of Maine, Portland, ME (USA)
Socio-economic and environmental inventory of the north Atlantic region - Sandy Hook to Bay of Fundy, 15:5242 (R;US)
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Research Triangle Inst., Research Triangle Park, NC (USA)
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Ricardo-ITI, Inc., Westmont, IL (USA)
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Risoe National Lab., Roskilde (Denmark)
Annual report 1988 Chemistry Department, 15:6469 (R;DK)
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Use of ^{15}N enriched plant material for labelling of soil nitrogen in legume dinitrogen fixation experiments, 15:5557 (R;DK)

Rochester Univ., NY (USA)
Solid state radiation chemistry of the DNA backbone: Progress report, November 15, 1987–July 13, 1989, 15:5931 (R;US)

Rockwell International Corp., Canoga Park, CA (USA)
OTVE combustor wall condition monitoring. Final report, November 1986-September 1988, 15:5672 (R;US)

Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant
Program plan for the development, evaluation, and application of the Terrain-Responsive Atmospheric Code (TRAC), 15:5841 (R;US)

Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations
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San Francisco, City and County of, CA (USA)
District heating and cooling at Mission Bay: Briefing paper, 15:5371 (R;US)

Sandia National Labs., Albuquerque, NM (USA)
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Sao Carlos Univ., SP (Brazil)
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Sao Paulo Univ., SP (Brazil). Inst. de Geociencias
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Secretaria Estadual de Ciencia e Tecnologia, Rio de Janeiro, RJ (Brazil)
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Shell Development Co., Houston, TX (USA)
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Bioavailable iron in typical Thai meals: Comparative studies between radioactive in vitro and in vivo food iron absorption measurements. Final report for the period 1 November 1986 - 31 October 1987, 15:5927 (R;XA)

Skovteknisk Inst., Copenhagen (Denmark)
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Southern Univ., Baton Rouge, LA (USA)
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Sovet Ehkonomicheskoj Vzaimopomoshchi, Moscow (USSR). Postoyannaya Komissiya po Ispol'zovaniyu Atomnoj Ehnergii v Mirnykh Tselyakh
Thermal physics 84. Thermal aspects of WWER nuclear reactor safety. V. 2. Collection of papers from CMEA seminar, Varna, October 1984, 15:5038 (R;XM)

SRI International, Menlo Park, CA (USA)
Low severity conversion of activated coal: Quarterly report no. 4, June 1, 1988–August 30, 1988, 15:4562 (R;US)
Low severity conversion of activated coal: Quarterly report No. 6, December 1, 1988–February 28, 1989, 15:4563 (R;US)
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Stanford Linear Accelerator Center, Menlo Park, CA (USA)
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Stanford Univ., CA (USA). Dept. of Operations Research
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Stanford Univ., CA (USA). Stanford Electronics Labs.
Surface, interface, and bulk properties of high-T_c superconductors. Final report, 30 September 1987-29 April 1989, 15:5470 (R;US)

State Univ. of New York, Albany, NY (USA). Research Foundation
Second year progress report on research project on CO_2-induced climate change, 15:5823 (R;US)
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State Univ. of New York, Buffalo, NY (USA). Dept. of Physics
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State Univ. of New York, Stony Brook, NY (USA). Dept. of Chemistry
Phase transition in polymer blends and structure of ionomers: Performance report, April 1, 1989–October 25, 1989, 15:5512 (R;US)
Statens Inst. for Strålehygiene, Oslo (Norway)
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Swedish Nuclear Fuel and Waste Management Co., Stockholm (Sweden)
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Systems, Science and Software, La Jolla, CA (USA)
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Technische Hochschule Darmstadt (Germany, F.R.)
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Tennessee Univ., Tullahoma, TN (USA). Space Inst.
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Texas A and M Univ., College Station, TX (USA). Research Foundation
Experimental high energy physics program at Texas A and M University: Annual progress report, April 1, 1989–March 31, 1990, 15:5737 (R;US)
Texas Univ., Austin, TX (USA). Dept. of Physics
Kinetic studies following state-selective laser excitation: Progress report, March 15, 1987–March 14, 1990, 15:5680 (R;US)
Toy (Wesley M.), Saratoga, CA (USA)
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Transport Canada, Ottawa, ON (Canada). Research and Development
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Hydro-Quebec development plan, 1989-1991. 1998 outlook: Synthesis document, 15:5279 (R;CA)
Triangle Universities Nuclear Lab., Durham, NC (USA)
[Studies of nuclear structure using neutrons and charged particles]: Progress report, September 1, 1988–August 31, 1989, 15:6101 (R;US)

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UKAEA Harwell Lab. (UK)
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UKAEA Harwell Lab. (UK). Chemistry Div.
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Theoretical Physics Division progress report. October 1987 - September 1988, 15:6450 (R;GB)

UKAEA Northern Research Labs., Risley (UK)
FIREFLY 6 (FIRECOMET) (HELLFIRE 8B). A revised and extended computer program for calculating the intensities of reflections on X-ray or neutron powder diffraction records, 15:6233 (R;GB)

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UNESP, Rio Claro, SP (Brazil). Inst. de Geociencias e Ciencias Exatas
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United Nations, Geneva (Switzerland). Economic Commission for Europe
Symposium on current developments and trends in underground storage of natural gas and LPG [liquefied petroleum gas]: Summary, 15:4730 (R;CH)

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Universidade Federal, Rio de Janeiro, RJ (Brazil). Coordenacao dos Programas de Pos-graduacao de Engenharia
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University City Science Center, Philadelphia, PA (USA)
Energy management assistance for small and medium-size manufacturers: Manufacturers' evaluations of EADCs' services, 1988–1989, 15:5356 (R;US)

University Coll., London (UK). Centre for Marine Technology
Semisubmersible data base. V. 1: Final project report, 15:5676 (R;GB)

University of Southern California, Marina Del Rey, CA (USA). Information Sciences Inst.
ISI's (Information Sciences Institute) SDI (Strategic Defense Initiative) architecture simulator: An experiment in adding new software to the system. Research report, 15:5815 (R;US)
ISI's (Information Sciences Institute) SDI (Strategic Defense Intiative) architecture simulator: Initial prototype user interface. Research report, 15:5816 (R;US)

UOP, Inc., Des Plaines, IL (USA)
Upgrading of light Fischer-Tropsch products: Quarterly report No. 8, July 1, 1988–September 30, 1988, 15:4921 (R;US)
Upgrading of light Fischer-Tropsch products: Quarterly report No. 9, October 1, 1988–December 31, 1988, 15:4922 (R;US)

USDOE Assistant Secretary for Conservation and Renewable Energy, Washington, DC (USA). Building Equipment Div.
Technical support document: Energy conservation standards for consumer products: Refrigerators and furnaces including: environmental impacts regulatory impact analysis, 15:5318 (R;US)

USDOE Assistant Secretary for Environment, Safety, and Health, Washington, DC (USA)
Technical safety appraisal of the West Valley Demonstration Project, 15:4758 (R;US)

USDOE Assistant Secretary for Fossil Energy, Washington, DC (USA). Office of Oil, Gas and Shale Technology
Contracts for field projects and supporting research on enhanced oil recovery: Progress review no. 57, quarter ending December 31, 1989, 15:4682 (R;US)

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USDOE Bartlesville Project Office, OK (USA)
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USDOE Energy Information Administration, Washington, DC (USA)
Monthly energy review, 15:5269 (R;US)

USDOE Energy Information Administration, Washington, DC (USA). Office of Coal, Nuclear, Electric and Alternate Fuels
Coal production 1988, 15:4633 (R;US)
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USDOE Energy Information Administration, Washington, DC (USA). Office of Oil and Gas
Natural gas monthly, September 1989, 15:4719 (R;US)
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USDOE Office of Energy Research, Washington, DC (USA)
Western fossil fuels R and D public meeting: Summary proceedings, 15:5270 (R;US)

USDOE Office of Energy Research, Washington, DC (USA). Advanced Energy Projects Div.
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Virginia Polytechnic Inst. and State Univ., Blacksburg, VA (USA). Dept. of Geological Sciences
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Virginia Univ., Charlottesville, VA (USA)
Photon interactions with nuclei: Progress report, 15:6102 (R;US)

Virginia Univ., Charlottesville, VA (USA). Dept. of Electrical Engineering
Sis (superconductor-insulator-superconductor) mixer research. Final technical report, November 1987-November 1988, 15:5621 (R;US)

Virginia Univ., Charlottesville, VA (USA). Dept. of Environmental Sciences
The ecology of the seagrass meadows of the west coast of Florida: A community profile, 15:5886 (R;US)

Volcanological Society of Japan (Japan)
Bulletin of volcanic eruptions. Number 26.Annual report of the world volcanic eruptions in 1986, 15:5974 (R;JP)

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Washington Univ., Seattle, WA (USA)
Graded band-gap solar cells. Final report, 1 September 1984-30 September 1988, 15:4928 (R;US)

Washington Univ., Seattle, WA (USA). Dept. of Physics
$^3P_0$ and $^3S_1$ contributions to $\bar{p}p \rightarrow \bar{\Lambda}\Lambda$, 15:6059 (R;US)

Washington Univ., Seattle, WA (USA). Inst. for Nuclear Theory
Charge symmetry breaking: An overview, 15:6076 (R;US)

Waterloo Univ., ON (Canada). Waterloo Centre for Process Development
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West Virginia Univ., Morgantown, WV (USA). Dept. of Geology
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Western Research Inst., Laramie, WY (USA)
A correlation of United States tar sand bitumen viscosities with NMR spectroscopic parameters: Progress report, 15:4745 (R;US)

Westinghouse Electric Corp., Madison, PA (USA). Waste Technology Services Div.
Evaluation of alternative waste package concepts for spent fuel, 15:4834 (R;US)

Westinghouse Electric Corp., Pittsburgh, PA (USA). Advanced Energy Systems Div.
Investigation of the irradiation-swelling mechanisms in refractory metals at high temperatures. Final scientific report, 1 March 1985-31 July 1988, 15:5405 (R;US)

Westinghouse Electric Corp., Pittsburgh, PA (USA). Research Labs.
Kapitza conductance of crystals cleaved under He II, 15:5619 (R;US)

Westinghouse Electric Corp., Pittsburgh, PA (USA). Science and Technology Center
Advanced study in solid transport: Rheological behavior of dense suspension: Fourth quarterly report, July 1, 1989–September 30, 1989, 15:4639 (R;US)

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Chukchi Sea coastal studies: Coastal geomorphology, environmental sensitivity, and persistence of spilled oil. Final report, 15:4703 (R;US)

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	15:6476	K/DSRD–112-Vol.1
	15:4796	ORNL/Sub–89-AJ015GA1/1
	Sunpower, Inc., Athens, OH (USA)	
	15:5305	CONF-891208–14
	Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data	
	15:5197	NUREG/CR–2000-Vol.8-No.9
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Issue Resolution	
	15:5205	NUREG/CR–5420
AC05-84OT21400	**Oak Ridge Gaseous Diffusion Plant, TN (USA)**	
	15:4752	K/ETO–4
	15:5655	K/CSD/INF–89/5
	15:6045	K/QT–279
AC06-76RL01830	**Pacific Northwest Lab., Richland, WA (USA)**	
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	15:5282	PNL–7173
	15:5342	PNL–6991
	15:5455	PNL-SA–17432
	15:5521	PNL-SA–17327
	15:5522	PNL-SA–17607
	15:5556	PNL-SA–16112
	15:5642	PNL-SA–17355
	15:5668	PNL-SA–16885
	15:5901	PNL-SA–17100
	15:5905	PNL-SA–16838
	15:5957	PNL-SA–16867
	15:5964	PNL-SA–17179
	15:6455	PNL-SA–17239
	15:6467	PNL-SA–15982
	15:6480	PNL-SA–17603
	15:5341	PNL–6986

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AC06-77RL01030	**Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations**	
	15:4774	DOE/RL/01030–T9
	15:4776	DOE/RL/01030–T19
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	15:4803	RHO-BWI-DP–041
	15:4804	RHO-BWI-DP–042
	15:4805	RHO-BWI-DP–043
	15:4806	RHO-BWI-DP–045-Rev.1
	15:4807	RHO-BWI-DP–048
	15:4808	RHO-BWI-DP–049
	15:4809	RHO-BWI-DP–050
	15:4810	RHO-BWI-DP–051
	15:4811	RHO-BWI-DP–052
	15:4812	RHO-BWI-DP–055
	15:4813	RHO-BWI-DP–059
	15:4814	RHO-BWI-DP–064
	15:4815	RHO-BWI-ER–010
	15:4819	RHO-BWI-PD–012
	15:4821	RHO-BWI-SA–123
	15:4823	RHO-BWI-TA–006
	15:4824	RHO-BWI-TA–007-Rev.1
	15:4825	RHO-BWI-TA–013
	15:4826	RHO-BWI-TD–012
	15:4827	RHO-BWI-TI–023
	15:4828	RHO-BWI-TI–089
	15:4829	RHO-BWI-TI–095
	15:4830	RHO-BWI-TI–102
	15:4831	RHO-BWI-TI–105
	15:4835	RHO-BWI-TI–203
	15:4836	RHO-BWI-TI–226-Rev.1
	15:4837	RHO-BWI-TI–226-Rev.1
	15:4838	RHO-BWI-TI–227
	15:4841	RHO-BWI-TI–230
	15:4842	RHO-BWI-TI–232
	15:4844	RHO-BWI-TI–234
	15:4847	RHO-BWI-TI–247
	15:4848	RHO-BWI-TI–249
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	15:4853	RHO-BWI-TI–258
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	15:4857	RHO-BWI-TI–276
	15:4858	RHO-BWI-TI–303
	15:4859	RHO-BWI-TRP–004
	15:4860	RHO-BWI-TS–008
	15:4861	RHO-BWI-TS–012
	15:4862	RHO-BWI-TY–001
	15:4863	RHO-BWI-VP–002
	15:4864	RHO-BWI-VP–005
	15:4865	RHO-BWI-VP–010380-01-Rev.1
	15:4866	RHO-BW-ST–51P
	15:4775	DOE/RL/01030–T15
	15:4820	RHO-BWI-PD–015
	15:4832	RHO-BWI-TI–177
	15:4833	RHO-BWI-TI–190
	15:4834	RHO-BWI-TI–202
	15:4839	RHO-BWI-TI–228
	15:4840	RHO-BWI-TI–229
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	15:4845	RHO-BWI-TI–235
	15:4846	RHO-BWI-TI–238
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	Pacific Northwest Lab., Richland, WA (USA)	
	15:4855	RHO-BWI-TI–263
AC06-80RL10000	**Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations**	
	15:4816	RHO-BWI-ES–015
	15:4818	RHO-BWI-ES–021
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AC06-87RL10930	**Westinghouse Hanford Co., Richland, WA (USA)**	
	15:4756	WHC-SA–0777
	15:4773	DOE/RL–89-09-Draft-Rev.A
	15:4871	WHC-SA–0607
	15:4885	WHC-SA–0775
	15:4888	WHC-SA–0776
	15:5825	DOE/RL–89-12
	15:5850	DOE/RL–89-18
	15:5882	WHC-SA–0779
AC07-76ID01570	**Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research**	
	15:5204	NUREG/CR–5406-Vol.3
	EG and G Idaho, Inc., Idaho Falls, ID (USA)	
	15:4567	EGG-M–89194
	15:4917	EGG-M–89038
	15:5167	EGG-M–88339
	15:5178	EGG-M–88175
	15:5179	EGG-M–88177
	15:5203	NUREG/CR–5406-Vol.1
	15:6350	EGG-M–89249
	15:5358	EGG-M–89039
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering	
	15:5006	NUREG/CR–5406-Vol.2
	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Systems Research	
	15:5198	NUREG/CR–4639-Vol.4-Pt.1-Rev.1
	15:5199	NUREG/CR–4639-Vol.4-Pt.2-Rev.1
	15:5200	NUREG/CR–4639-Vol.4-Pt.3-Rev.1
AC07-86ID12584	**UNC Geotech, Grand Junction, CO (USA)**	
	15:4880	DOE/ID/12584–45
AC07-88ID12735	**MSE, Inc., Butte, MT (USA)**	
	15:5287	DOE/ID/12735–T4
AC08-88NV10617	**EG and G, Inc., Las Vegas, NV (USA). Remote Sensing Lab.**	
	15:5854	EGG–10617-1010
AC09-89SR18035	**Savannah River Lab., Aiken, SC (USA)**	
	15:5426	DPST–61-183
	Westinghouse Savannah River Co., Aiken, SC (USA)	
	15:4889	WSRC-RP–89-308
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	15:5207	RTR–2661
	15:5366	WSRC-RP–89-792
	15:5425	DP-MS–89-27
	15:5786	WSRC-RP–1017
	15:5883	WSRC-RP–89-59-1-Vol.1
	15:5884	WSRC-RP–89-59-1-Vol.2
	15:5948	WSRC-RP–89-964
	15:5128	WSRC-RP–89-679
	15:5843	WSRC-RP–89-793
AC21-84MC21063	**KRW Energy Systems, Inc., Madison, PA (USA)**	
	15:4560	DOE/MC/21063–2740-Vol.1
	15:4561	DOE/MC/21063–2740-Vol.2

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AC21-86MC23075	Brigham Young Univ., Provo, UT (USA). Combustion Lab.	
	15:4590	CONF-881143--8
AC22-86PC90014	UOP, Inc., Des Plaines, IL (USA)	
	15:4921	DOE/PC/90014--T4
	15:4922	DOE/PC/90014--T5
AC22-86PC90279	Energy and Environmental Research Corp., Irvine, CA (USA)	
	15:4643	DOE/PC/90279--T15
AC22-87PC79652	Avco-Everett Research Lab., Everett, MA (USA)	
	15:4641	DOE/PC/79652--T2
AC22-87PC79936	SRI International, Menlo Park, CA (USA)	
	15:4562	DOE/PC/79936--4
	15:4563	DOE/PC/79936--6
	15:4564	DOE/PC/79936--7
AC22-88PC88827	Pennsylvania State Univ., University Park, PA (USA). Coll. of Earth and Mineral Sciences	
	15:4707	DOE/PC/88827--T4
AC22-88PC88866	North Dakota Univ., Grand Forks, ND (USA). Energy and Mineral Research Center	
	15:4982	DOE/PC/88866--T5
AC22-88PC88882	Babcock and Wilcox Co., Alliance, OH (USA). Research and Development Div.	
	15:4553	DOE/PC/88882--T4
AC[illegible]-88PC88883	Battelle Memorial Inst., Columbus, OH (USA)	
	15:4554	DOE/PC/88883--T4
AC22-88PC88884	EXPORTech Co., Inc., New Kensington, PA (USA)	
	15:4555	DOE/PC/88884--T4
AC22-88PC88891	Institute of Gas Technology, Chicago, IL (USA)	
	15:4565	DOE/PC/88891--T2
AC22-88PC88949	Westinghouse Electric Corp., Pittsburgh, PA (USA). Science and Technology Center	
	15:4639	DOE/PC/88949--T4
AI01-87ER13663	National Inst. of Standards and Technology, Gaithersburg, MD (USA). Surface Science Div.	
	15:5422	DOE/ER/13663--T3
AI79-86BP63401	Lawrence Berkeley Lab., CA (USA)	
	15:5324	LBL--26069
AS05-76ER03956	Tennessee Univ., Knoxville, TN (USA). Dept. of Physics	
	15:5736	DOE/ER/03956--8
AS05-81ER40039	Texas A and M Univ., College Station, TX (USA). Research Foundation	
	15:5737	DOE/ER/40039--25
	Texas A and M Univ., College Station, TX (USA). Dept. of Physics	
	15:5738	DOE/ER/40039--31
AT03-76ER70023	Stanford Linear Accelerator Center, Menlo Park, CA (USA)	
	15:5782	SLAC-PUB--5105
FC01-87CE40806	University City Science Center, Philadelphia, PA (USA)	
	15:5356	DOE/CE/40806--T2
FC07-88ID12711	Stone and Webster Engineering Corp., Boston, MA (USA)	
	15:5357	DOE/ID/12711--1
FC07-88ID12799	EG and G Idaho, Inc., Idaho Falls, ID (USA)	
	15:5358	EGG-M--89039
FC21-86MC11076	Western Research Inst., Laramie, WY (USA)	
	15:4745	DOE/MC/11076--2743
FC22-83FE60149	National Inst. for Petroleum and Energy Research, Bartlesville, OK (USA)	
	15:4685	NIPER--436
	15:4686	NIPER--445
FC22-87PC79798	Babcock and Wilcox Co., Barberton, OH (USA). Contract Research Div.	
	15:4591	DOE/PC/79798--T6
FG01-86CE15256	Pacific Northwest Lab., Richland, WA (USA)	
	15:5319	DOE/CE/15256--T2
FG01-88CE26571	San Francisco, City and County of, CA (USA)	
	15:5371	DOE/CE/26571--T5
FG02-84ER13224	Rensselaer Polytechnic Inst., Troy, NY (USA). High-Temperature Reaction Kinetics Lab.	
	15:5617	DOE/ER/13224--11
FG02-84ER13288	Purdue Univ., Lafayette, IN (USA). School of Chemical Engineering	
	15:5562	DOE/ER/13288--5
FG02-84ER45055	Cornell Univ., Ithaca, NY (USA). Dept. of Materials Science	
	15:5423	DOE/ER/45055--24
FG02-85ER13347	Kansas State Univ., Manhattan, KS (USA). Dept. of Chemistry	
	15:5794	DOE/ER/13347--3
FG02-85ER60314	State Univ. of New York, Albany, NY (USA). Research Foundation	
	15:5823	DOE/ER/60314--T1
FG02-86ER13460	Yale Univ., New Haven, CT (USA)	
	15:5563	DOE/ER/13460--T2
FG02-86ER13500	Wisconsin Univ., Madison, WI (USA)	
	15:6021	DOE/ER/13500--T1
FG02-86ER13506	Syracuse Univ., NY (USA). Dept. of Chemistry	
	15:4929	DOE/ER/13506--24
FG02-86ER40251	Kent State Univ., OH (USA). Dept. of Physics	
	15:6157	DOE/ER/40251--4
FG02-86ER45237	State Univ. of New York, Stony Brook, NY (USA). Dept. of Chemistry	
	15:5512	DOE/ER/45237--T1
FG02-86ER45239	State Univ. of New York, Albany, NY (USA). Research Foundation	
	15:6223	DOE/ER/45239--T1
FG02-87ER13665	Brown Univ., Providence, RI (USA). Dept. of Geological Sciences	
	15:4959	DOE/ER/13665--1
FG02-87ER13700	Iowa Univ., Iowa City, IA (USA)	
	15:6022	DOE/ER/13700--2
FG02-87ER13773	Yale Univ., New Haven, CT (USA). Dept. of Applied Physics	
	15:5564	DOE/ER/13773--2
FG02-87ER45283	Brookhaven National Lab., Upton, NY (USA)	
	15:5789	BNL--43421
FG02-87ER45294	Massachusetts Inst. of Tech., Cambridge, MA (USA). Dept. of Mechanical Engineering	
	15:5424	DOE/ER/45294--3
FG02-88ER13858	Arizona Univ., Tucson, AZ (USA). Dept. of Physics	
	15:6287	DOE/ER/13858--2
FG02-88ER13875	Wisconsin Univ., Madison, WI (USA)	
	15:4910	DOE/ER/13875--T1
FG02-88ER13914	Massachusetts Inst. of Tech., Cambridge, MA (USA)	
	15:5565	DOE/ER/13914--13
FG02-88ER13949	Illinois Univ., Urbana, IL (USA)	
	15:5511	DOE/ER/13949--T1

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FG02-88ER13962	Montana Bureau of Mines and Geology, Butte, MT (USA)	
	15:5966	DOE/ER/13962–1
FG02-88ER60625	Rochester Univ., NY (USA)	
	15:5931	DOE/ER/60625–1
FG02-88ER60648	Pennsylvania State Univ., University Park, PA (USA). Dept. of Chemistry	
	15:5567	DOE/ER/60648–2
FG02-88MI10132	Bronx Community Coll., New York, NY (USA)	
	15:5235	DOE/MI/10132–1
FG03-87ER25028	Stanford Univ., CA (USA). Dept. of Operations Research	
	15:6482	SOL–89-17
FG03-87ER25030	Stanford Univ., CA (USA). Dept. of Operations Research	
	15:6482	SOL–89-17
FG04-87AL44658	Lawrence Livermore National Lab., CA (USA)	
	15:5395	UCRL–101594
FG05-84ER13191	Texas Univ., Austin, TX (USA). Dept. of Physics	
	15:5680	DOE/ER/13191–10
FG05-87ER13675	North Carolina Univ., Chapel Hill, NC (USA). William R. Kenan, Jr. Labs. of Chemistry	
	15:5228	DOE/ER/13675–3
FG05-88ER13843	Research Triangle Inst., Research Triangle Park, NC (USA)	
	15:4690	DOE/ER/13843–1
FG05-88ER40441	Triangle Universities Nuclear Lab., Durham, NC (USA)	
	15:6101	DOE/ER/01067–T7
FG05-88ER40442	Triangle Universities Nuclear Lab., Durham, NC (USA)	
	15:6101	DOE/ER/01067–T7
FG05-89ER14003	Oklahoma Univ., Norman, OK (USA). Dept. of Botany and Microbiology	
	15:5903	DOE/ER/14003–1
FG05-89ER40501	Virginia Univ., Charlottesville, VA (USA)	
	15:6102	DOE/ER/40501–1
FG06-85ER40224	Oregon Univ., Eugene, OR (USA). Inst. of Theoretical Science	
	15:6053	DOE/ER/40224–96
	15:6058	DOE/ER/40224–92
	15:6078	DOE/ER/40224–105
FG06-88ER40427	Washington Univ., Seattle, WA (USA). Dept. of Physics	
	15:6059	DOE/ER/40427–17-N9
	Washington Univ., Seattle, WA (USA). Inst. for Nuclear Theory	
	15:6076	DOE/ER/40427–16-N9
FG06-89ER14047	Oregon State Univ., Corvallis, OR (USA). Dept. of Microbiology	
	15:5904	DOE/ER/14047–2
FG07-87ID12693	Oregon Inst. of Tech., Klamath Falls, OR (USA)	
	15:4965	DOE/ID/12693–T6
	Oregon Inst. of Tech., Klamath Falls, OR (USA). Geo-Heat Center	
	15:4964	CONF-891031–8
FG08-88ER13945	Nevada Univ., Reno, NV (USA)	
	15:5566	DOE/ER/13945–1
FG22-87PC79914	Purdue Univ., Lafayette, IN (USA). School of Chemical Engineering	
	15:4585	DOE/PC/79914–T9
FG22-87PC79916	Kentucky Univ., Lexington, KY (USA). Dept. of Mechanical Engineering	
	15:4642	DOE/PC/79916–7
FG22-87PC79931	Texas A and M Univ., College Station, TX (USA). Center for Electrochemical Systems and Hydrogen Research	
	15:5296	DOE/PC/79931–T4
FG22-88PC88920	Idaho Univ., Moscow, ID (USA). Coll. of Mines and Earth Resources	
	15:4566	DOE/PC/88920–T5
W-31109-ENG-38	Argonne National Lab., IL (USA)	
	15:4602	CONF-891080–1
	15:4646	CONF-8903176–1
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	15:5735	CONF-891087–11
	15:5821	CONF-8911110–2
	15:5848	CONF-891098–2
	15:5888	CONF-8906245–1
	15:6018	ANL/PPRNT–89-187
	15:6020	CONF-890813–2
	15:6049	ANL-HEP-CP–89-110
	15:6050	ANL-HEP-CP–89-125
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	15:6155	CONF-8911128–2
	15:6156	CONF-8911128–3
	15:6220	CONF-891119–23
	15:6221	CONF-891119–25
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	15:6343	CONF-891007–98
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	15:6349	CONF-8909234–2
	15:6470	ANL/TM–431-Rev.2
	15:6473	CONF-891251–2
	Sandia National Labs., Albuquerque, NM (USA)	
	15:5523	SAND–89-0685C

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	Argonne National Lab., IL (USA). Environmental Assessment and Information Sciences Div.	
	15:5846	ANL/EAIS/TM-1
W-7405-ENG-36	**Argonne National Lab., IL (USA)**	
	15:6155	CONF-8911128-2
	Los Alamos National Lab., NM (USA)	
	15:4683	LA-UR-89-2546
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	15:4786	LA-UR-89-3701
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	15:6325	LA-UR-89-3687
	15:6326	LA-UR-89-3741
	15:6477	LA-11606-MS
	15:6478	LA-11681-MS
W-7405-ENG-48	**Argonne National Lab., IL (USA)**	
	15:6222	CONF-8810246-6
	Lawrence Livermore National Lab., CA (USA)	
	15:4645	UCRL-21232
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	15:5381	UCRL-102147
	15:5395	UCRL-101594
	15:5396	UCRL-102001
	15:5458	UCRL-100649
	15:5459	UCRL-101350
	15:5460	UCRL-102036
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	15:5531	UCRL-101602
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	15:5646	UCRL-100652
	15:5678	CONF-8709110-26
	15:5694	UCID-21543
	15:5695	UCRL-100354
	15:5696	UCRL-101071
	15:5697	UCRL-101633
	15:5730	UCID-21819
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	15:5785	UCRL-102155
	15:5792	UCRL-101579
	15:5800	UCRL-101939
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	15:5809	UCID-21826
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	15:5812	UCRL-101559
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	Nuclear Regulatory Commission, Washington, DC (USA). Div. of Engineering	
	15:5206	NUREG/CR-5470

Report Number Index

The report number index consists of the alphanumeric identifiers assigned to report literature as well as patent and conference literature cited in this publication. Entries provide the abstract number; the source(s) of availability of the document; the GPO file prefix for GPO depository library documents; the order number for OSTI and NTIS report ordering purposes; and, if the document was distributed under the DOE distribution program, the category number is shown for paper copy (PC), microfiche (MF), or no distribution (ND). These categories are included to assist DOE librarians in responding to requests for reports in their collections. The index also lists secondary numbers, with the corresponding abstract numbers and cross-references to other identifying numbers.

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AC/CB–					
1775/E	15:5353	PC Agriculture Canada, Communications Branch, Sir John Carling Bldg., Carling Ave., Ottawa, ON, CAN K1A 0C5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
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AI/N–					
89-02740	15:4699	PC Dept. of Environment and Lands, Elizabeth Towers, Elizabeth Ave., P.O. Box 4750, St. John's, NF, CAN A1C 5T7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
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64600-9/89-FR	15:5908	NTIS, PC A15/MF A01; OSTI; INIS		DE90003096	
AMA–					
89-02696	15:5298	PC Alberta Legislative Library, 216 Legislature Bldg., Edmonton, AB, CAN T5K 2B6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
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89-110	15:6049	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003825	MF-414
89-125	15:6050	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003195	MF-414
89-67	15:5711	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002209	MF-414
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431-Rev.2	15:6470	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002631	MF-405
ANS-R–					
595-15	15:4882	*See* DOE-RW–89.046			
APUB–					
89-03789	15:5265	PC Public Utilities Board for the Province of Alberta, 10055-106th St., 11th Floor, Edmonton, Alta., CAN T5J 2Y2; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
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89-02165-3	15:4582	PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
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17-1989	15:5818	Available from: Swedish Council for Building Research, Stockholm (SE)			

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BIOLOGICAL–					
85(1.19)	15:5953	*See* PB–89-235998/XAB			
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293	15:4631	Bureau of Mineral Resources, Geology and Geophysics, Canberra, ACT (Australia)			
BMU–					
1989-227	15:4757	Available from GRM Werbeberatung - Werbemittlung - PR, Eggenstein-Leopoldshafen, (Germany, F.R.)			
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89-14	15:5731	NTIS (US Sales Only), PC A03/MF A01		DE90728786	
89-24	15:6075	Available from Bonn Univ. (Germany, F.R.). Physikalisches Inst.			
BR–					
82(11.114)	15:5847	OSTI; Fish and Wildlife Service, NASA-Slidell Computer Complex, 1010 Gauss Boulevard, Slidell, LA 70458		TI90003383	
85(7.22)	15:5885	NTIS, PC A06/MF A01; OSTI; U.S. Fish annd Wildlife Service Publications Unit, 18th and C Streets, N.W., Mail Stop 1111, Arlington Square Bldg., Washington, DC 20240		DE90003524	
85(7.25)	15:5886	OSTI; U.S. Fish and Wildlife Service, 18th and C Streets, N.W., Mail stop 1111, Arlington Square Building, Washington, DC 20240		TI90003492	
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CE/IWD–					
89-03831	15:4923	PC Water Survey of Canada, Place Vincent Massey, 351 St. Joseph Blvd., Ottawa, ON, CAN K1A 0E7; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
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CE-02788	15:5213	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST FUNDS CAN			
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89-1	15:4717	Canadian Energy Research Institute, 3512-33rd St. NW, Calgary, AB, CAN T2L 2A6. Prices: $30.00 CAN			
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8961701	15:5472	*See* AD-A–211651/5/XAB			
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CE-02645	15:4736	Alberta Oil Sands Technology and Research Authority, 500 Highfield Pl., 10010-106 St., Edmonton, AB, CAN T5J 3L8. Prices: N/C		DE90705984	
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7	15:6219	*See* CNEA-NT–3/89			
CNEN-DR–					
108/81	15:5012	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90608644	
CNEN-NN–					
6.04	15:6190	Centro de Informacoes Nucleares of the Comissao Nacional de Energia Nuclear, RJ, Brazil			
CONF-7811229–		(3. Brazilian Congress of Engineering Geology; Sao Paulo (Brazil); Nov 1978)			
	15:4784	*See* INIS-BR–1758			
CONF-8006286–		(Workshop on scintillating fiber detector development for the SSC; Batavia, IL (USA); 11-16 Jun 1980)			
1	15:5711	*See* ANL-HEP-CP–89-67			
CONF-810624–		(22. US symposium on rock mechanics; Cambridge, MA (USA); 29 Jun - 2 jul 1981)			
14	15:4821	*See* RHO-BWI-SA–123			
CONF-8210363–		(14. annual symposium of the Canadian mineral analysts; Thunder Bay (Canada); 19-21 Oct 1982)			
	15:4583	*See* ARC/CR–CE-02439			
CONF-8410495–		(Thermal physics '84: thermal aspects of WWER nuclear reactor safety; Varna (Bulgaria); Oct 1984)			
	15:5038	*See* INIS-mf–11564			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8512160--		(2. symposium of amazon geology; Belem (Brazil); 1-9 Dec 1985)			
	15:5755	*See* INIS-BR-1756			
CONF-8610132--		(14. annual Illinois energy conference: energy in Illinois and the Midwest - the changing economic and regulatory scene; Chicago, IL (USA); 30-31 Oct 1986)			
	15:5271	Illinois Dept. of Energy and Natural Resources, 325 West Adams, Room 300, Springfield, IL 62706			
CONF-8611245--		(5. seminar on safety and operating reliability of reactor WWER; Marianske Lazne (Czechoslovakia); 5-6 Nov 1986)			
1	15:5177	*See* DOE-tr-89-9			
CONF-8612131--		(Materials Research Society symposium on interfaces, superlattices and thin films; Boston, MA (USA); 1-6 Dec 1986)			
	15:5461	Materials Research Society, 9800 Mc Knight Rd., Suite 327, Pittsburgh, PA 15237			
CONF-8705391--		(4. international symposium on second law analysis of thermal systems; Rome (Italy); 25-30 May 1987)			
1	15:5568	*See* ETDE-IT-89-26			
CONF-8705394--		(4. seminar of chemical control in metallurgy; Belo Horizonte (Brazil); 25-27 May 1987)			
	15:4587	*See* INIS-BR-1763			
CONF-8705397--		(Specialists' meeting on the human factor information feedback in nuclear power - implications of operating experience on system analysis, design and operation; Roskilde (Denmark); 25-27 May 1987)			
	15:5148	*See* ETDE-IT-89-40			
CONF-870636--		(5. national congress on pressure vessels and piping; San Diego, CA (USA); 28 Jun - 2 jul 1987)			
	15:5209	American Society of Mechanical Engineers, 345 East 47 St., New York, NY 10017			
CONF-8706404--		(Conference on applied mathematics; Cambridge, MA (USA); 22-24 Jun 1987)			
1	15:6372	*See* UCRL-97251			
CONF-870690--		(3. Windsor workshop on alternative fuels; Windsor (Canada); 24-26 Jun 1987)			
	15:5389	*See* ORF-TE-87-12			
CONF-8709110--		(9. international free-electron laser conference; Williamsburg, VA (USA); 14-18 Sep 1987)			
26	15:5678	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003049	MF-706
CONF-8709481--		(7. National Research Council of Canada (NRCC) symposium on industrial application of gas turbines; Banff (Canada); 27-30 Sep 1987)			
	15:5637	*See* NRC/ACP-89-03549			
CONF-8710503--		(Technical committee on fission molybdenum for medical use; Karlsruhe (Germany, F.R.); 13-16 Oct 1987)			
	15:4893	*See* IAEA-TECDOC-515			
CONF-8710504--		(Symposium on the aerial application of pesticides in forestry; Ottawa (Canada); 20-22 Oct 1987)			
	15:5929	*See* NRC-29197			
CONF-880110--		(SPIE O-E Lase '88: optoelectronics and laser applications in science and engineering; Los Angeles, CA (USA); 10-17 Jan 1988)			
38	15:6373	*See* UCRL-97924			
CONF-8804308--		(1. workshop on the Building System Integration Laboratory; Washington, DC (USA); 5-6 Apr 1988)			
Summ.	15:5342	*See* PNL-6991			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-880510–		(IAEA-ECC international symposium on the management of low and intermediate level radioactive wastes; Stockholm (Sweden); 16-20 May 1988)			
5	15:4779	*See* ENEA-RT-COMB–89-08			
CONF-880512–		(8. international conference on plasma surface interactions in controlled fusion devices; Julich (Germany, F.R.); 2-6 May 1988)			
Exc.	15:6353	*See* ENEA-RT-FUS–88-21			
CONF-8805226–		(European two-phase flow group meeting; Brussels (Belgium); 30 May - 1 jun 1988)			
	15:5011	*See* CEGB-RD/M–1717/RR88			
CONF-8806243–		(DPF summer study: Snowmass '88: high energy physics in the 1990s; Snowmass, CO (USA); 27 Jun - 15 jul 1988)			
46	15:5780	*See* SCIPP–88/40			
CONF-8806395–		(17. International colloquium on group theoretical methods in physics; Sainte-Adele, CA (USA); 27 Jun - 2 jul 1988)			
	15:6034	*See* LYCEN–88-28			
CONF-8806405–		(Seminar on recovery of energy from municipal and industrial waste through combustion; Cambridge (UK); 21-24 Jun 1988)			
	15:4912	*See* ETSU-L–25			
CONF-880764–		(24. AIAA/ASME/SAE/ASEE joint propulsion conference; Boston, MA (USA); 11-13 Jul 1988)			
	15:5672	*See* N–89-26899			
CONF-8808203–		(35. Scottish University summer school in physics: laser plasma interactions '88; St. Andrews (UK); 7-20 Aug 1988)			
1	15:6375	*See* UCRL–99302			
CONF-8808218–		(8. international conference on basement tectonics; Butte, MT (USA); Aug 1988)			
Suppl.	15:5966	*See* DOE/ER/13962–1			
CONF-880833–		(World congress on medical physics and biomedical engineering; San Antonio, TX (USA); 6-12 Aug 1988)			
	15:5924	*See* NAC–88-14			
CONF-880912–		(196. American Chemical Society national meeting; Los Angeles, CA (USA); 25-30 Sep 1988)			
33	15:5528	*See* UCRL–98598			
CONF-8809150–		(IAEA technical committee meeting on design requirements, operation and maintenance of gas-cooled reactors; San Diego, CA (USA); 21-23 Sep 1988)			
	15:5078	*See* IWGGCR–19			
CONF-880929–		(15. symposium on fusion technology; Utrecht (Netherlands); 19-23 Sep 1988)			
13	15:5485	*See* ENEA-RT-FUS–88-20			
CONF-8809310–		(International workshop on properties of ceramics and their measurements; Ustica (Italy); 12-16 Sep 1988)			
1	15:5486	*See* ENEA-RT-FUS–88-24			
CONF-8809397–		(7. international district heating conference; Prague (Czechoslovakia); Sep 1988)			
	15:4992	*See* INIS-mf–11563			
CONF-8809416–		(2. international symposium on probability methods applied to electric power systems; Oakland, CA (USA); 20-23 Sep 1988)			
	15:5214	*See* EPRI-EL–6555			
CONF-8809418–		(3. Symposium on Geoscience Quantification; Rio Claro (Brazil); 1-3 Sep 1988)			
	15:5856	*See* INIS-BR–1704			
CONF-8809420–		(Technical committee on water reactor fuel element computer modelling in steady state, transient and accident conditions; Preston (UK); 18-22 Sep 1988)			
	15:5129	*See* IWGFPT–32			
CONF-8809421–		(Workshop on FEL; Frascati (Italy); 26 Sep 1988)			
Exc.	15:5685	*See* ENEA-RT-TIB–88-46			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8809425–		(IEA workshop on air quality, heating and cooling of buildings; Goeteborg (Sweden); 12-14 Sep 1988)			
	15:5818	*See* BFR-D–17-1989			
CONF-881009–		(4. international conference on liquid metal engineering and technology; Avignon (France); 17-21 Oct 1988)			
6	15:5183	*See* ETDE-IT–89-20			
7	15:5104	*See* ETDE-IT–89-18			
CONF-881024–		(TMI-2 accident materials behavior, plant technology and recovery; Washington, DC (USA); 30 Oct - 4 nov 1988)			
19	15:5179	*See* EGG-M–88177			
20	15:5178	*See* EGG-M–88175			
CONF-8810246–		(20. annual symposium on optical materials for high-power lasers; Boulder, CO (USA); 26-28 Oct 1988)			
6	15:6222	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003807	MF-400
CONF-8810304–		(Technical committee meeting on research using small tokamaks; Nice (France); 10-12 Oct 1988)			
	15:6295	*See* IAEA-TECDOC–519			
CONF-8810442–		(Fiber-optic sensing workshop; Charlotte, NC (USA); 6 Oct 1988)			
	15:5791	*See* EPRI-ER–6537			
CONF-8810445–		(Office productivity and workstation environment control workshop; Palo Alto, CA (USA); 11-12 Oct 1988)			
Summ.	15:5321	*See* EPRI-CU–6556			
CONF-8810450–		(Advisory group on technical and economic benefits of nuclear techniques in ore processing; Krakow (Poland); 24-28 Oct 1988)			
	15:5544	*See* IAEA-TECDOC–520			
CONF-8810453–		(European community wind energy conference; Herning (Denmark); 6-10 Oct 1988)			
1	15:4968	*See* ETDE-IT–89-36			
CONF-8810454–		(Quarterly meeting of the Canadian Heavy Oil Association; Calgary (Canada); 25 Oct 1988)			
	15:4737	*See* CHOA–02645			
CONF-881099–		(15. Canadian rock mechanics symposium; Toronto (Canada); 3-4 Oct 1988)			
	15:4736	*See* CHOA–CE-02645			
CONF-8811175–		(Beyond the standard model; Ames, IA (USA); 18-22 Nov 1988)			
6	15:6078	*See* DOE/ER/40224–105			
CONF-8811198–		(Meeting on bioclimatic architecture, energy conservation and environmental quality: prospectives and applications in the design and construction of public buildings and schools; Rome (Italy); 9-10 Nov 1988)			
	15:4936	NTIS (US Sales Only), PC A19		DE90724628	
CONF-8811248–		(Workshop on industrial building energy use; Berkeley, CA (USA); 7 Nov 1988)			
	15:5327	*See* LBL–27658			
CONF-8811289–		(Rare decay symposium; Vancouver (Canada); 30 Nov - 3 dec 1988)			
1	15:6058	*See* DOE/ER/40224–92			
CONF-8811290–		(Technical committee on the safe management of spent fuel from research reactors, prototype power reactors and fuel from commercial power reactors that has been subjected to post-irradiation examinatio; Vienna (Austria); 28 Nov - 1 dec 1988)			
	15:4759	*See* IAEA-TECDOC–513			
CONF-8811293–		(Plant operating, maintenance and production conference; Calgary (Canada); 17 Nov 1988)			
	15:4711	*See* CGPA–CE-02784			
CONF-881143–		(American Institute of Chemical Engineers annual meeting; Washington, DC (USA); 27 Nov - 2 dec 1988)			
	15:4872	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
	15:5658	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			
	15:5659	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			
	15:5660	American Institute of Chemical Engineers, 345 East 47 St., New York, NY 10017			
8	15:4590	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002928	MF-113
CONF-8812120–		(Round table meeting on chemical and physical valorization of coal; Brussels (Belgium); 21 Dec 1988)			
	15:4569	*See* EUR–12066-FR			
CONF-8901170–		(9. wind energy symposium; New Orleans, LA (USA); 14-18 Jan 1989)			
1	15:4974	*See* PNL-SA–17459			
CONF-8902123–		(1. international vacuum mechatronics workshop; Santa Barbara, CA (USA); 2-3 Feb 1989)			
	15:5647	American Inst. of Physics, 335 E. 45th St., New York, NY 10017			
CONF-8902150–		(1989 Engineering Foundation conference on traffic control methods; Santa Barbara, CA (USA); 26 Feb - 3 mar 1989)			
1	15:5345	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002933	MF-406
CONF-8902151–		(1989 Lake Louise winter institute: frontiers in physics–from colliders to cosmology; Lake Louise (Canada); 19-25 Feb 1989)			
1	15:6053	*See* DOE/ER/40224–96			
CONF-8903174–		(3. Pacific Basin biofuels workshop; Waianae, HI (USA); 27-28 Mar 1989)			
	15:4906	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002523	MF-241
CONF-8903175–		(Recontre de Moriond conference; Les Arcs (France); 12-17 Mar 1989)			
2	15:6174	*See* LBL–27690			
CONF-8903176–		(53. annual meeting of the Midwest Economics Association; Cincinnati, OH (USA); 30 Mar - 1 apr 1989)			
1	15:4646	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002244	MF-121; MF-131
CONF-890335–		(13. particle accelerator conference; Chicago, IL (USA); 20-23 Mar 1989)			
271	15:5712	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003821	MF-414
CONF-890379–		(Workshop on calorimetry for the SSC; Tuscaloosa, AL (USA); 13-17 Mar 1989)			
17	15:5781	*See* SLAC-PUB–5072			
CONF-8904210–		(Cray user's group conference; Los Angeles, CA (USA); 24-28 Apr 1989)			
4-Rev.1	15:6485	*See* UCRL–101076-Rev.1			
CONF-8904226–		(12. international workshop on weak interactions and neutrinos; Ginosar (Israel); 9-14 Apr 1989)			
13	15:6049	*See* ANL-HEP-CP–89-110			
CONF-890426–		(Spring meeting of the Materials Research Society; San Diego, CA (USA); 24-28 Apr 1989)			
31	15:5522	*See* PNL-SA–17607			
32	15:5475	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003826	MF-405
CONF-8904290–		(Symposium J: interfaces between polymers, metals and ceramics; San Diego, CA (USA); 24-29 Apr 1989)			
4	15:5417	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003823	MF-404
CONF-8904292–		(3. International conferencer on surface modification technologies; Neuchatel (Switzerland); 19 Apr 1989)			
1	15:5458	*See* UCRL–100649			
CONF-8904293–		(CERN Working Group on rare Z boson decays; Geneva (Switzerland); 10-14 Apr 1989)			
1	15:6066	*See* LBL–27047			
CONF-890491–		(International conference on fifty years of research in nuclear fission; Berlin (Germany, F.R.); 3-7 Apr 1989)			
	15:6125				

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-890502–		(Seminar on current developments and trends on underground storage of natural gas and liquefied petroleum gas; Paris (France); 29 May - 3 jun 1989)			
Summ.	15:4730	NTIS (US Sales Only), PC A03/MF A01 - OSTI		DE90000086	
CONF-8905118–		(2. international conference on trends in welding research; Gatlinburg, TN (USA); 15-19 May 1989)			
13	15:5456	*See* SAND–89-1764C			
CONF-8905192–		(Conference on X-ray microimaging for the life sciences; Berkeley, CA (USA); 24-26 May 1989)			
	15:5798	*See* LBL–27660			
CONF-890520–		(International conference: inside the sun; Versailles (France); 22-26 May 1989)			
3	15:6002	*See* UCRL–102150			
4	15:6051	NTIS, PC A02/MF A01; OSTI; INIS		DE90003790	MF-412
CONF-8905241–		(Society of Plastics Engineers annual technical conference; Dallas, TX (USA); 7-11 May 1989)			
1	15:5531	*See* UCRL–101602			
CONF-8905242–		(1. Brazilian congress on Energy Planning; Campinas (Brazil); 8-12 May 1989)			
	15:5260	*See* INIS-BR–1693			
CONF-8905244–		(IAEA specialists' meeting on Fusion Evaluated Nuclear Data Library (FENDL) and benchmark calculation; Vienna (Austria); 8-11 May 1989)			
	15:6363	*See* INDC(NDS)–223/GF			
CONF-8905246–		(2. Asian symposium on research reactors (ASRR-II); Serpong (Indonesia); 23-25 May 1989)			
	15:5116	*See* INDC(INS)–001			
CONF-890582–		(Biological processing of coal and coal-derived substances; Palo Alto, CA (USA); 16-17 May 1989)			
3	15:4567	*See* EGG-M–89194			
CONF-8906129–		(13. DOE solar photochemistry conference; Silvercreek, CO (USA); 11-15 Jun 1989)			
2	15:4929	*See* DOE/ER/13506–24			
CONF-8906235–		(Symposium on spin and symmetries; Vancouver (Canada); 30 Jun - 2 jul 1989)			
2	15:6076	*See* DOE/ER/40427–16-N9			
CONF-8906239–		(Santa Fe Institute summer school on complex systems; Santa Fe, NM (USA); 5-30 Jun 1989)			
2	15:6046	*See* LA-UR–89-3984			
CONF-8906245–		(Air Pollution Control Association (APCS) meeting; Los Angeles, CA (USA); 23-30 Jun 1989)			
1	15:5888	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002169	MF-630
CONF-8906250–		(9. international conference on distributed computing systems; Newport Beach, CA (USA); 5-9 Jun 1989)			
1	15:6479	*See* LBL–25435			
CONF-8906253–		(15. annual conference of the Solar Energy Society of Canada; Penticton (Canada); 19 Jun 1989)			
	15:5334	*See* NRC–29348F			
CONF-890665–		(7. Institute of Electrical and Electronics Engineers pulsed power conference; Monterey, CA (USA); 12-14 Jun 1989)			
52	15:5646	*See* UCRL–100652			
CONF-890699–		(Symposium on importance of nuclear power for power supply after 1990: benefits and difficulties; Rio de Janeiro (Brazil); 11-15 Jun 1989)			
	15:4989	*See* INIS-BR–1690			
	15:5110	*See* INIS-BR–1742			
CONF-890710–		(5. international conference on megagauss magnetic field generation and related topics; Novosibirsk (USSR); 3-7 Jul 1989)			
23	15:6048	*See* UCRL–100585			

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CONF-8907127--		(12. few body conference: few body problems in physics; Vancouver (Canada); 2-8 Jul 1989)			
5	15:6059	*See* DOE/ER/40427--17-N9			
CONF-8907136--		(NATO advanced research workshop on radiative corrections: results and perspectives; Brighton (UK); 9-14 Jul 1989)			
2	15:6096	*See* LA-UR--89-3784			
CONF-8907139--		(International School of Materials Science and Technology: earlier and recent aspects of superconductivity; Erice (Italy); 4-16 Jul 1989)			
3	15:6239	*See* BNL--43107			
CONF-8907166--		(8. annual American Statistical Association conference on radiation and health: health effects of electric and magnetic fields: statistical support for research strategies; Cooper Mountain, CO (USA); 9-13 Jul 1989)			
1	15:5964	*See* PNL-SA--17179			
CONF-8907167--		(Joint Operations Weapons Operations Group conference; Aldermaston (UK); 11 Jul 1989)			
1	15:5530	*See* UCRL--101381			
CONF-8907168--		(7. IEEE pulsed power conference; Monterey, CA (USA); 11-14 Jul 1989)			
1	15:5695	*See* UCRL--100354			
2	15:6330	*See* UCRL--100359			
CONF-8907170--		(2. international conference on batteries for utility energy storage; Newport Beach, CA (USA); 24-28 Jul 1989)			
1	15:5226	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002188	
CONF-8907171--		(Symposium on the formation and evolution of cosmic strings; Cambridge (UK); 2-7 Jul 1989)			
1	15:5989	*See* FNAL/C--89/221-A			
1	15:6099	*See* RAL--89-076			
2	15:6077	*See* DOE/ER/03130--433			
CONF-8907173--		(3. Brazilian congress on Defense of the Environment; Rio de Janeiro (Brazil); 24-28 Jul 1989)			
	15:5159	*See* INIS-BR--1757			
CONF-890756--		(17. international symposium on shock waves and shock tubes (STS-17); Bethlehem, PA (USA); 17-21 Jul 1989)			
4	15:5352	*See* UCRL--101677			
CONF-890770--		(Conference on review of progress in quantitative NDE; Brunswick, ME (USA); 23-28 Jul 1989)			
7	15:5476	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003812	MF-114
CONF-890802--		(7. synchrotron radiation instrumentation (SRI) national conference; Berkeley, CA (USA); 6-10 Aug 1989)			
17	15:5785	*See* UCRL--102155			
18	15:5789	*See* BNL--43421			
CONF-890803--		(International conference on high energy accelerators; Tsukuba (Japan); 20-26 Aug 1989)			
42	15:5726	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003797	MF-414
CONF-890813--		(7. international conference on dynamical processes in excited states of solids; Athens, GA (USA); 28 Aug - 2 sep 1989)			
2	15:6020	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003795	MF-401
CONF-8908133--		(24. Yamada conference on strongly coupled plasma physics; Tokyo (Japan); 29 Aug - 2 sep 1989)			
8	15:6331	*See* UCRL--100805			
CONF-8908134--		(11. international free electron laser conference; Naples, FL (USA); 28 Aug - 1 sep 1989)			
17	15:5688	*See* LA-UR--89-3786			
18	15:5687	*See* LA-UR--89-3763			
19	15:5696	*See* UCRL--101071			
CONF-8908181--		(2. international symposium on mass spectrometry in the health and life sciences; San Francisco, CA (USA); 27-31 Aug 1989)			
1	15:5905	*See* PNL-SA--16838			

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CONF-8908182–		(9. session of the international seminars on nuclear war; Erice (Italy); 19-24 Aug 1989)			
1	15:5842	*See* UCRL–101837			
CONF-8908183–		(2. international conference on electrorheological fluids; Raleigh, NC (USA); 7-9 Aug 1989)			
1	15:6047	*See* SAND–89-2604C			
CONF-8908184–		(3. meeting of the Brazilian Congress of Physicists in Medicine; Aguas de Lindoia (Brazil); 23-26 Aug 1989)			
	15:5754	*See* INIS-BR–1751			
	15:5909	*See* INIS-BR–1692			
CONF-8908185–		(International conference on optical and optoelectronics and applied science; San Diego, CA (USA); 14-18 Aug 1989)			
1	15:6377	*See* UCRL–101663			
CONF-8908186–		(European conference on mathematics in industry; Glasgow (UK); 28-31 Aug 1989)			
1	15:5625	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003683	MF-405
CONF-8908187–		(2. state meeting of new materials and 1. Florida-Brazil seminar on materials; Rio de Janeiro (Brazil); 2-4 Aug 1989)			
	15:5489	*See* INIS-BR–1752			
	15:5753	*See* INIS-BR–1694			
CONF-890836–		(33. SPIE annual international technical symposium on optical and optoelectronic applied science and engineering; San Diego, CA (USA); 6-11 Aug 1989)			
19	15:5784	*See* UCRL–101630			
CONF-890850–		(11. international conference on magnet technology; Tsukuba (Japan); 28 Aug - 1 sep 1989)			
3	15:6376	*See* UCRL–100532			
5	15:5722	*See* SLAC-PUB–5073			
CONF-890872–		(Workshop on physics at Fermilab in the 1990's; Breckenridge, CO (USA); 15-24 Aug 1989)			
4	15:6050	*See* ANL-HEP-CP–89-125			
CONF-890890–		(9. international heat transfer conference; Jerusalem (Israel); 19-24 Aug 1989)			
2	15:5128	*See* WSRC-RP–89-679			
CONF-890903–		(International Europhysics conference on high-energy physics; Madrid (Spain); 7-14 Sep 1989)			
4	15:6055	*See* SLAC-PUB–5114			
CONF-8909141–		(12. international meeting on reduced enrichment for research and test reactors; Berlin (Germany, F.R.); 10-13 Sep 1989)			
4	15:5369	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90001441	MF-940
6	15:5166	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001430	MF-940
CONF-8909163–		(5. symposium on containment of underground nuclear detonations; Santa Barbara, CA (USA); 19-21 Sep 1989)			
7	15:5813	*See* UCRL–101955			
8	15:5811	*See* UCRL–100961			
9	15:5810	*See* UCRL–100837			
CONF-8909204–		(Conference on hydrogen effects on material behavior; Jackson Hole, WY (USA); 12-16 Sep 1989)			
5	15:5425	*See* DP-MS–89-27			
CONF-8909207–		(EMAG-MICRO 89 meeting; London (UK); 13-15 Sep 1989)			
3	15:5418	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003804	MF-404
CONF-8909221–		(HADRON '89: 3rd international conference on hadron spectroscopy; Ajaccio (France); 23-27 Sep 1989)			
3	15:6097	*See* LA-UR–89-4030			
4	15:6056	*See* SLAC-PUB–5139			
CONF-8909234–		(Advisory group meeting on nuclear data for radiation damage assessment and related safety aspects; Vienna (Austria); 19-22 Sep 1989)			
2	15:6349	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003803	MF-423

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8909249–		(Lattice '89 international workshop; Capri (Italy); Sep 1989)			
2	15:6080	*See* FNAL/C–89/220			
CONF-8909267–		(7. international conference on liquid and amorphous metals; Kyoto (Japan); 4-8 Sep 1989)			
1	15:5419	NTIS, PC A02/MF A01 - OSTI		DE90001436	MF-401
2	15:5420	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003805	MF-404
CONF-8909268–		(IAEA consultants' meeting on cross sections for the generation of long-lived radionuclides; Argonne, IL (USA); 13-14 Sep 1989)			
1	15:6153	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003073	MF-413
CONF-8909270–		(3. workshop on high energy spin physics; Protvino (USSR); 5-7 Sep 1989)			
1	15:6054	*See* FNAL/C–89/216			
CONF-8909272–		(Research in air space law symposium; Montreal (Canada); Sep 1989)			
1	15:5398	*See* LA-UR–89-3684			
CONF-890928–		(Nuclear waste isolation in the unsaturated zone: FOCUS '89; Las Vegas, NV (USA); 18-21 Sep 1989)			
17	15:4869	*See* UCRL–101615			
CONF-890930–		(2. international conference on engineering management; Toronto (Canada); 10-13 Sep 1989)			
3	15:5738	*See* DOE/ER/40039–31			
CONF-890982–		(International meeting on neutron activation cross sections for fission and fusion energy applications; Argonne, IL (USA); 11-15 Sep 1989)			
7	15:6341	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003802	MF-423
CONF-891006–		(Joint international waste management conference; Kyoto (Japan); 23-28 Oct 1989)			
9	15:4871	*See* WHC-SA–0607			
CONF-891007–		(13. IEEE symposium on fusion engineering; Knoxville, TN (USA); 2-6 Oct 1989)			
100	15:6344	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003808	MF-424
101	15:6345	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003765	MF-420
97	15:6342	NTIS, PC A02/MF A01; OSTI; INIS		DE90003685	MF-420
98	15:6343	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003769	MF-424
CONF-8910107–		(Electrochemical Society fall meeting; Hollywood, FL (USA); 15-20 Oct 1989)			
4	15:5227	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003774	MF-212
CONF-8910120–		(1. international ceramic science and technology congress; Anaheim, CA (USA); 31 Oct - 3 nov 1989)			
4	15:5679	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003571	MF-364
5	15:5483	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003570	MF-364
6	15:5484	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003569	MF-404; MF-364
CONF-8910162–		(11. annual North American conference of the International Association for Energy Economists; Los Angeles, CA (USA); 16-18 Oct 1989)			
5	15:4718	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003809	MF-131
CONF-8910201–		(2. All-Union workshop on new methods of particle acceleration; Noramberd (USSR); 10-14 Oct 1989)			
2	15:5727	NTIS, PC A02/MF A01; OSTI; INIS		DE90003766	MF-414
CONF-8910216–		(Ultrasonics symposium; Montreal (Canada); 3 Oct 1989)			
2	15:5799	*See* SAND–89-1472C			
CONF-8910224–		(American Defense Preparedness Association annual meeting; New Orleans, LA (USA); 3-4 Oct 1989)			
1	15:5693	*See* SAND–89-2259			
CONF-891024–		(The Metallurgical Society fall meeting: materials week; Indianapolis, IN (USA); 1-5 Oct 1989)			
4	15:5668	*See* PNL-SA–16885			
6	15:5411	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003773	MF-504
CONF-8910243–		(European space power conference; Madrid (Spain); 2-6 Oct 1989)			
	15:4930	*See* N–89-27868			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-8910259--		(IAEA technical committee meeting on alpha particles/confinement and heating; Kiev (USSR); 23-26 Oct 1989)			
3	15:6289	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003716	MF-427
CONF-8910260--		(Plutonium/uranium recovery operations conference; Oak Ridge, TN (USA); 24-26 Oct 1989)			
2	15:4885	*See* WHC-SA--0775			
3	15:4888	*See* WHC-SA--0776			
4	15:4756	*See* WHC-SA--0777			
CONF-8910264--		(Asilomar conference on signals, systems and computers; Monterey, CA (USA); 31 Oct 1989)			
2	15:5973	*See* UCRL--102168			
CONF-8910276--		(4. international workshop on desorption induced by electronic transitions; Gloggnitz (Austria); 2-4 Oct 1989)			
2	15:6036	*See* SAND--89-1118C			
CONF-8910280--		(Joint meeting of the U.S. DOE (PETC)/Japan AIST-NEDO Committee on Coal Liquefaction; Tokyo (Japan); 27 Oct - 10 nov 1989)			
2	15:4559	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002465	MF-114
CONF-8910289--		(Western States Section meeting of the Combustion Institute; Livermore, CA (USA); 23-24 Oct 1989)			
1	15:5381	*See* UCRL--102147			
3	15:5396	*See* UCRL--102001			
4	15:5395	*See* UCRL--101594			
CONF-8910295--		(8. international conference on entity-relationship approach; Toronto (Canada); 18-20 Oct 1989)			
2	15:6492	*See* LBL--27070			
CONF-8910296--		(American Electroplaters and Surface Finishers symposium; Las Vegas, NV (USA); Oct 1989)			
1	15:5459	*See* UCRL--101350			
2	15:5697	*See* UCRL--101633			
CONF-8910298--		(1989 Western regional conference of the American Society for Quality Control; Salt Lake City, UT (USA); 26 Oct 1989)			
1	15:6467	*See* PNL-SA--15982			
CONF-8910299--		(National Educators workshop; Norfolk, VA (USA); 17-19 Oct 1989)			
1	15:5901	*See* PNL-SA--17100			
CONF-8910300--		(DOE real property management conference; Las Vegas, NV (USA); 30 Oct - 3 nov 1989)			
1	15:5642	*See* PNL-SA--17355			
CONF-8910301--		(1989 thermionic conversion specialists conference; Eindhoven (Netherlands); 9-12 Oct 1989)			
1	15:5289	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002849	MF-701
CONF-8910303--		(IEEE colloquium of large scale programs for use in antenna performance predictions; London (UK); 30 Oct 1989)			
1	15:5800	*See* UCRL--101939			
CONF-8910304--		(TMS meeting on simulation and theory of evolving microstructures; Indianapolis, IN (USA); Oct 1989)			
1	15:5446	*See* LA-UR--89-3721			
CONF-8910306--		(15. European Hadron Facility workshop; Lecce (Italy); 9-14 Oct 1989)			
1	15:5709	*See* LA-UR--89-3713			
CONF-8910307--		(International symposium on virus genes and plant pathogenesis; Lexington, KY (USA); 15-17 Oct 1989)			
1	15:5904	*See* DOE/ER/14047--2			
CONF-8910308--		(5. Florida workshop in nonlinear astronomy: nonlinear astrophysical fluid dynamics; Gainesville, FL (USA); 5-7 Oct 1989)			
1	15:5999	*See* LA-UR--89-3772			
CONF-891031--		(Annual meeting of the Geothermal Resources Council; Santa Rosa, CA (USA); 1-4 Oct 1989)			
8	15:4964	NTIS, PC A07/MF A01 - OSTI		DE90003230	MF-257

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
CONF-891044–		(1. international conference on radioactive nuclear beams; Berkeley, CA (USA); 16-18 Oct 1989)			
2	15:6019	*See* BNL–43514			
3	15:5734	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003810	MF-413
CONF-891072–		(27. Hanford symposium on health and the environment: multilevel research–molecules to man; Richland, WA (USA); 18-20 Oct 1989)			
5	15:5957	*See* PNL-SA–16867			
CONF-891080–		(6. international coal trade, transportation and handling conference: Coal Trans '89; London (UK); 16-18 Oct 1989)			
1	15:4602	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003770	MF-101
CONF-891087–		(IEEE nuclear science symposium and exhibits; San Francisco, CA (USA); 25-27 Oct 1989)			
7	15:5770	*See* LA-UR–89-3538			
11	15:5735	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003815	MF-413
CONF-891093–		(36. American Vacuum Society national vacuum symposium; Boston, MA (USA); 23-27 Oct 1989)			
10	15:5412	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002496	MF-406
14	15:4579	*See* SAND–89-1318C			
15	15:5474	*See* BNL–43461			
CONF-891094–		(International conference on accelerator and large experimental physics control systems; Vancouver (Canada); 30 Oct - 3 nov 1989)			
4	15:5718	*See* BNL–43066			
5	15:5710	*See* SLAC-PUB–5126			
6	15:5782	*See* SLAC-PUB–5105			
CONF-891096–		(Building retrofit innovative concepts fair; Washington, DC (USA); 24 Oct 1989)			
1-Vugraphs	15:5300	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002499	MF-350
CONF-891097–		(High powered microwave and broadband radio frequency propagation/phenomenology/methodology workshop; Livermore, CA (USA); 23-26 Oct 1989)			
2	15:5692	*See* SAND–89-2109C			
CONF-891098–		(The scientific challenge of NEPA: future directions based on 20 years of experience; Knoxville, TN (USA); 24-27 Oct 1989)			
2	15:5848	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003196	MF-511
4	15:5820	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003704	MF-402
CONF-891103–		(Winter meeting of the American Nuclear Society; San Francisco, CA (USA); 26-30 Nov 1989)			
42	15:5176	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003054	MF-406
48	15:4755	*See* LA-UR–89-3837			
51	15:4889	*See* WSRC-RP–89-308			
58	15:5556	*See* PNL-SA–16112			
CONF-891104–		(9. international conference on solid state dosimetry; Vienna (Austria); 6-10 Nov 1989)			
1	15:5783	*See* SLAC-PUB–5122			
CONF-891106–		(31. annual meeting of the Division of Plasma Physics of the American Physical Society; Anaheim, CA (USA); 13-17 Nov 1989)			
8-Vugraphs	15:6288	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003703	MF-420
CONF-8911101–		(ASM conference on methods for reducing scrap in producing tubes, bars and shapes; Clearwater, FL (USA); 6-7 Nov 1989)			
2	15:5455	*See* PNL-SA–17432			
CONF-8911109–		(10. DOE Atomic Physics Program workshop; Berkeley, CA (USA); 8-9 Nov 1989)			
Summ.	15:6033	*See* LBL–27850			
CONF-8911110–		(Symposium on environmental perspectives towards the year 2000 and beyond; Bangkok (Thailand); 6-10 Nov 1989)			
2	15:5821	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003553	MF-402
CONF-8911111–		(Service water systems reliability improvement seminar; Charlotte, NC (USA); 6-8 Nov 1989)			
1	15:5173	*See* BNL-NUREG–43090			

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CONF-8911112–		(14. annual Army environmental R and D symposium; Williamsburg, VA (USA); 14-16 Nov 1989)			
1	15:6451	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002481	
2	15:5541	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003557	
CONF-8911116–		(APPAM conference; Washington, DC (USA); 1-4 Nov 1989)			
1	15:6452	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002467	
CONF-8911123–		(IAEA Technical Committee workshop on the impact of advanced technologies on reactor systems; Vienna (Austria); 6-9 Nov 1989)			
1	15:5144	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002939	MF-520
CONF-8911124–		(User group science seminar; Los Alamos, NM (USA); 16-17 Nov 1989)			
1-Vugraphs	15:5421	NTIS, PC A02/MF A01; OSTI; INIS		DE90003040	MF-404
CONF-8911125–		(SPIE symposium on advances in intelligent robotic systems; Philadelphia, PA (USA); 5-8 Nov 1989)			
1	15:5626	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003041	MF-406
CONF-8911128–		(NEANDC specialists' meeting on level densities; Bologna (Italy); 15-17 Nov 1989)			
1	15:6154	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003074	MF-413
2	15:6155	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003783	MF-413
3	15:6156	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003776	MF-413
CONF-8911129–		(Air Force tribology technical review; Fairborn, OH (USA); 27-30 Nov 1989)			
2	15:5527	*See* SAND–89-2767C			
CONF-891113–		(American Institute of Chemical Engineers annual meeting; San Francisco, CA (USA); 5-10 Nov 1989)			
3	15:5559	*See* SAND–89-0965C			
8	15:5294	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003548	MF-110
9	15:5295	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003547	MF-110
CONF-8911130–		(11. US/Japan workshop on field-reversed configurations and compact toroids; Los Alamos, NM (USA); 7-9 Nov 1989)			
1	15:6325	*See* LA-UR–89-3687			
2	15:6326	*See* LA-UR–89-3741			
CONF-8911132–		(Parallelization discussions; Yorktown Heights, NY (USA); 2-3 Nov 1989)			
1	15:6486	*See* UCRL–102059			
CONF-8911134–		(35. annual conference on bioassay, analytical and environmental radiochemistry; Charleston, SC (USA); 2 Nov 1989)			
1	15:5786	*See* WSRC-RP–1017			
2	15:5948	*See* WSRC-RP–89-964			
CONF-8911139–		(Conference on beam-solid interactions: physical phenomena; Boston, MA (USA); 27 Nov - 2 dec 1989)			
1	15:5502	*See* LA-UR–89-3841			
CONF-891117–		(34. conference on magnetism and magnetic materials; Boston, MA (USA); 28 Nov - 1 dec 1989)			
10	15:5413	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003555	MF-404
11	15:6240	*See* BNL–43407			
CONF-891119–		(Materials Research Society fall meeting; Boston, MA (USA); 27 Nov - 2 dec 1989)			
7	15:6286	*See* SAND–89-2536C			
11	15:5503	*See* LA-UR–89-3963			
12	15:5447	*See* LA-UR–89-4008			
12	15:5519	*See* LA-UR–89-3940			
13	15:6232	*See* LA-UR–89-4009			
14	15:5504	*See* LA-UR–89-4010			
15	15:6112	*See* SAND–89-1612C			
16	15:5414	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003565	MF-404
17	15:5477	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003566	MF-404
19	15:5478	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003559	MF-404; MF-201; MF-364
20	15:4769	*See* BNL–43449			
21	15:5525	*See* SAND–89-1653C			

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22	15:5508	*See* SAND–89-2793C			
23	15:6220	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003560	MF-404; MF-373
24	15:5479	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003561	MF-404
25	15:6221	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003562	MF-404
26	15:5415	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003563	MF-404
27	15:5480	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003709	MF-404
28	15:5460	*See* UCRL–102036			
29	15:4771	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003786	MF-401; MF-402
31	15:5416	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003787	MF-404
32	15:5507	*See* SAND–89-1727C			
33	15:5506	*See* SAND–89-1723C			
CONF-891120–		(Migration '89: 2nd international conference on chemistry and migration behavior of actinides and fission products in the geosphere; Monterey, CA (USA); 6-10 Nov 1989)			
6	15:4787	*See* LA-UR–89-3702			
7	15:4788	*See* LA-UR–89-3734			
CONF-891124–		(7. international conference on solid-state ionics; Hakone (Japan); 5-9 Nov 1989)			
1	15:5510	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003782	MF-404
2	15:5481	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003781	MF-404
CONF-891130–		(3. international conference on processing and utilization of high-sulphur coals; Ames, IA (USA); 14-18 Nov 1989)			
2	15:4558	*See* BNL–42489			
CONF-891132–		(9. battery and electrochemical contractors' conference; Alexandria, VA (USA); 13-17 Nov 1989)			
9	15:5225	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003573	MF-212
CONF-891163–		(21. annual symposium on optical materials for high power lasers; Boulder, CO (USA); 1-3 Nov 1989)			
1	15:5521	*See* PNL-SA–17327			
CONF-891197–		(Topical meeting on non-destructive assay of radioactive waste; Cadarache (France); 20-22 Nov 1989)			
4	15:4789	*See* LA-UR–89-3736			
CONF-891198–		(6. IEEE careers conference: engineering and engineering managers: challenges of the 90's; St. Petersburg, FL (USA); 1-3 Nov 1989)			
2	15:6455	*See* PNL-SA–17239			
CONF-891202–		(4. thermal performance of the exterior envelopes of buildings; Orlando, FL (USA); 4-7 Dec 1989)			
1	15:5301	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89016072	MF-350
2	15:5302	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89016287	MF-350
3	15:5303	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89015979	MF-350
4	15:5304	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000563	MF-350
5	15:5325	*See* LBL–26070			
6	15:5324	*See* LBL–26069			
CONF-891204–		(4. international conference on fusion reactor materials; Kyoto (Japan); 4-8 Dec 1989)			
1	15:5518	*See* LA-UR–89-3546			
2	15:5721	*See* LA-UR–89-3615			
3	15:6346	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002719	MF-423
4	15:6347	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002200	MF-423
5	15:6348	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003775	MF-423
CONF-891205–		(IEEE international electron devices meeting; Washington, DC (USA); 3-6 Dec 1989)			
1	15:5524	*See* SAND–89-1607C			
2	15:5792	*See* UCRL–101579			
CONF-891206–		(International chemical congress of Pacific Basin Society symposium on polymer rheology and processing (PACIFICHEM '89); Honolulu, HI (USA); 17-22 Dec 1989)			
1	15:4753	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89004909	MF-501
3	15:5523	*See* SAND–89-0685C			
4	15:4786	*See* LA-UR–89-3701			

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CONF-891208–		(Winter annual meeting of the American Society of Mechanical Engineers; San Francisco, CA (USA); 10-15 Dec 1989)			
	15:5674	*See* N–89-27980			
1	15:5482	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89007845	MF-404
2	15:4975	*See* SAND–88-3231C			
3	15:5655	*See* K/CSD/INF–89/5			
4	15:4954	*See* SAND–89-0246C			
5	15:4955	*See* SAND–89-0247C			
6	15:4957	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014778	
7	15:5354	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89013289	MF-310
8	15:5077	*See* GA-A–19618			
9	15:5645	*See* UCRL–99677			
10	15:6045	*See* K/QT–279			
11	15:5517	*See* LA-UR–89-2430			
12	15:5634	*See* LA-UR–89-2595			
13	15:5804	*See* LA-UR–89-2467			
14	15:5305	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89016070	MF-350
15	15:5358	*See* EGG-M–89039			
17	15:5221	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89016872	
19	15:5306	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000580	MF-350
20	15:4791	*See* LBL–27578			
21	15:6350	*See* EGG-M–89249			
22	15:4917	*See* EGG-M–89038			
23	15:5689	*See* LBL–27745			
24	15:5359	*See* KCP–613-4145			
25	15:5448	*See* LBL–27774			
CONF-891213–		(International Association of Mathematics and Computers Simulation conference; West Lafayette, IN (USA); 5-7 Dec 1989)			
1	15:6483	*See* UCRL–100557			
CONF-891214–		(Hypervelocity impact symposium; San Antonio, TX (USA); 12-14 Dec 1989)			
1	15:5624	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89008240	MF-405
2	15:5817	*See* UCRL–100496			
3	15:5633	*See* LA-UR–89-2342			
4	15:5632	*See* LA-UR–89-2309			
5	15:4683	*See* LA-UR–89-2546			
6	15:5643	*See* SAND–89-0607C			
7	15:4684	*See* LA-UR–89-3582			
8	15:5671	*See* SAND–89-0612C			
9	15:5670	*See* SAND–89-0598C			
10	15:5669	*See* SAND–89-0597C			
11	15:5666	*See* LA-UR–89-3791			
CONF-891220–		(French-Israeli workshop on solid state lasers; Jerusalem (Israel); 12-14 Dec 1989)			
1	15:6374	*See* UCRL–98989			
CONF-891222–		(Computer Measurement Group annual meeting; Reno, NV (USA); 11-15 Dec 1989)			
1	15:6484	*See* UCRL–100671			
CONF-891223–		(American Society for Testing and Materials conference; Orlando, FL (USA); 5 Dec 1989)			
1	15:5631	*See* LA-UR–89-1834			
CONF-891226–		(10. international conference on MHD electrical power generation; Tiruchirapalli (India); 4-8 Dec 1989)			
1	15:5824	*See* DOE/ET/10815–131			
CONF-891230–		(Symposium on mechanics of plastics and plastic composites; San Francisco, CA (USA); 10-15 Dec 1989)			
1	15:5526	*See* SAND–89-1820C			
CONF-891235–		(American Society of Mechanical Engineers symposium on computational techniques for impact, penetration and perforation of solids; San Francisco, CA (USA); 10-15 Dec 1989)			
1	15:5812	*See* UCRL–101559			
CONF-891241–		(International symposium on wave propagation in granular media; San Francisco, CA (USA); 10-14 Dec 1989)			
1	15:5532	*See* UCRL–101623			
2	15:4870	*See* UCRL–101882			

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CONF-891242–		(1. Pacific polymer conference; Maui, HI (USA); 12-15 Dec 1989)			
1	15:5529	*See* UCRL–101380			
CONF-891245–		(ASTM symposium on modern instrumental methods of elemental analysis of petroleum products and lubricants; New Orleans, LA (USA); 11-13 Dec 1989)			
1	15:4709	*See* SAND–89-1238C			
CONF-891251–		(28. IEEE conference on decision and control; Tampa, FL (USA); 13-15 Dec 1989)			
1	15:6472	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000572	MF-405; MF-406
2	15:6473	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001986	MF-405
CONF-891252–		(Faraday symposium: the Royal Society of Chemistry; London (UK); 12-14 Dec 1989)			
1	15:5608	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89016853	MF-401
CONF-891253–		(5. Australian workshop on oil shale; Sydney (Australia); 7-8 Dec 1989)			
1	15:4742	*See* UCRL–102123			
CONF-891254–		(Symposium on concurrent product and process design; San Francisco, CA (USA); 11-15 Dec 1989)			
1	15:6475	*See* KCP–613-4206			
CONF-891255–		(11. international conference on lasers and applications; Lake Tahoe, NV (USA); 4-9 Dec 1989)			
1	15:5167	*See* EGG-M–88339			
CONF-891256–		(IAEA Consultants meeting; Espoo (Finland); 11-13 Dec 1989)			
1	15:4748	*See* LA-UR–89-3911			
CONF-891257–		(Special operations and low-intensity conflict symposium: defending US interests; Alexandria, VA (USA); 4-5 Dec 1989)			
1	15:5801	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003713	MF-700
1	15:5802	*See* SAND–89-1913C			
CONTRIB–					
628	15:5954	*See* PB–89-237176/XAB			
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EPS3/HA/5	15:5849	PC Environment Canada. Environmental Protection Publications, 10 Wellington St., 12th PVM, Ottawa, ON, CAN K1A 0H3; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
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029/89	15:5114	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608646	

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09/87	15:4687	*See* OTO–87-007			
DCN–					
87-258-012-25-02	15:5385	*See* PB–89-229843/XAB			
DDTF/P–					
125	15:4878	*See* AERE-R–12902			
DECG–					
432G494	15:4640	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN			
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90002425	15:5739	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002425	MF-406; MF-414
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89-12	15:5825	NTIS, PC A06/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003494	MF-502
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DOE/RL/01030–					
T15	15:4775	OSTI; INIS		TI90003481	MF-813
T19	15:4776	OSTI; INIS		TI90003480	MF-813
T9	15:4774	OSTI; INIS		TI90003482	MF-813
DOE/SF/16299–					
T12	15:4962	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003044	MF-250
DP-MS–					
89-27	15:5425	NTIS, PC A03/MF A01 - OSTI		DE90003505	MF-704
DPST–					
61-183	15:5426	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003915	MF-701; MF-704
E–					
4869	15:4930	*See* N–89-27868			
4962	15:5674	*See* N–89-27980			
EC–					
CCD88-06	15:5238	PC Climate Program Office, Canadian Climate Centre, 4905 Dufferin Street, Downsview, ON, CAN N9B 3P4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
EC/IWD–					
156	15:5892	PC Environment Canada, Library Services, Terrasses de la Chaudiere, 10 Wellington St., Ottawa, ON, CAN K1A 0H3; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
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10617-1010	15:5854	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003308	PC-707
2458-Vol.4-Pt.1-Rev.1	15:5198	*See* NUREG/CR–4639-Vol.4-Pt.1-Rev.1			
2458-Vol.4-Pt.2-Rev.1	15:5199	*See* NUREG/CR–4639-Vol.4-Pt.2-Rev.1			
2458-Vol.4-Pt.3-Rev.1	15:5200	*See* NUREG/CR–4639-Vol.4-Pt.3-Rev.1			
2569-Vol.1	15:5203	*See* NUREG/CR–5406-Vol.1			
2569-Vol.2	15:5006	*See* NUREG/CR–5406-Vol.2			
2569-Vol.3	15:5204	*See* NUREG/CR–5406-Vol.3			
EGG-M–					
88175	15:5178	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002034	MF-523
88177	15:5179	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002000	MF-523
88339	15:5167	NTIS, PC A03/MF A01; OSTI; INIS		DE90002018	MF-520
89038	15:4917	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002084	MF-249
89039	15:5358	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89016359	MF-310
89194	15:4567	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001750	MF-102
89249	15:6350	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002015	MF-516
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1144	15:4720	Available from the British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ			

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8805	15:5258	PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 555 Booth St., Rm. 342, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
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89-1	15:4886	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610949	
89-06	15:4778	NTIS (US Sales Only), PC A04/MF A01		DE90724679	
89-07	15:5627	NTIS (US Sales Only), PC A03		DE90724608	
89-08	15:4779	NTIS (US Sales Only), PC A03/MF A01		DE90724681	
89-09	15:5542	NTIS (US Sales Only), PC A04/MF A01		DE90724680	
89-10	15:5628	NTIS (US Sales Only), PC A04/MF A01		DE90724607	
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88-24	15:4953	NTIS (US Sales Only), PC A04		DE90724613	
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88-21	15:6353	NTIS (US Sales Only), PC A03/MF A01		DE90705981	
88-22	15:6291	NTIS (US Sales Only), PC A03/MF A01		DE90724702	
88-24	15:5486	NTIS (US Sales Only), PC A03/MF A01		DE90724611	
88-25	15:6356	NTIS (US Sales Only), PC A03/MF A01		DE90724683	
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600/J-88/358	15:5364	*See* PB–89-237978/XAB			
600/J-88/365	15:5363	*See* PB–89-237366/XAB			
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EPA/AA/TSS/PA–					
88/1	15:5386	*See* PB–89-230676/XAB			
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EPRI-NP–					
6559	15:5182	Research Reports Center, Box 50490, Palo Alto, CA 94303			
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89-26	15:5568	NTIS (US Sales Only), PC A04/MF A01		DE90705982	
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89-29	15:5013	NTIS (US Sales Only), PC A03		DE90724689	
89-30	15:5629	NTIS (US Sales Only), PC A03/MF A01		DE90724615	
89-31	15:5014	NTIS (US Sales Only), PC A05		DE90724711	
89-32	15:5145	NTIS (US Sales Only), PC A02/MF A01		DE90724719	
89-33	15:6294	NTIS (US Sales Only), PC A03/MF A01		DE90724713	
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89-35	15:5146	NTIS (US Sales Only), PC A03/MF A01		DE90724717	
89-36	15:4968	NTIS (US Sales Only), PC A02		DE90724626	
89-38	15:5147	NTIS (US Sales Only), PC A02		DE90724718	
89-39	15:4969	NTIS (US Sales Only), PC A03		DE90724627	
89-40	15:5148	NTIS (US Sales Only), PC A03		DE90724720	
89-41	15:5015	NTIS (US Sales Only), PC A10		DE90724712	
89-42	15:5016	NTIS (US Sales Only), PC A04		DE90724714	
89-43	15:5017	NTIS (US Sales Only), PC A03/MF A01		DE90724715	
89-44	15:5018	NTIS (US Sales Only), PC A08		DE90724716	
89-45	15:6041	NTIS (US Sales Only), PC A03/MF A01		DE90724542	
ETDE/CA-MS–					
M91-7/44-1989E	15:5322	PC Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
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M91-7/45-1989E	15:5323	PC Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
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12066-FR	15:4569	Commission of the European Communities (Luxembourg)			
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1910	15:5115	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610111	
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87-1	15:5851	*See* DOE-RW–88.032			
FNAL/C–					
89/215-A	15:6077	*See* DOE/ER/03130–433			
89/216	15:6054	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003344	MF-414
89/220	15:6080	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003543	MF-410
89/221-A	15:5989	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003128	MF-414
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3554	15:4691	NTIS (US Sales Only), PC A12/MF A01		DE90727180	
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8901	15:4576	NTIS (US Sales Only), PC A13		DE90724841	
8902	15:4552	NTIS (US Sales Only), PC A13		DE90724915	
FURNAS-DPE-O–					
100	15:5019	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608698	
GA-A–					
19618	15:5077	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89014318	MF-522
19651	15:6329	*See* UCRL–21247			
GKSS–					
89/E/17	15:5427	Special print from Mater. Sci. Eng., A (Mar 1989) v. 110(1/2) p. L5-L8			
89/E/29	15:5543	Special print from Spectrochim. Acta, Part B (1989) v. 44(5) p. 437-452			
GL-TR–					
89-0206	15:5979	*See* AD-A–211686/1/XAB			
89-0212	15:5981	*See* AD-A–211701/8/XAB			
89-0215	15:5987	*See* AD-A–211743/0/XAB			
89-0216	15:5978	*See* AD-A–211685/3/XAB			
89-0218	15:5980	*See* AD-A–211700/0/XAB			
GNT–					
08/81	15:5012	*See* CNEN-DR–108/81			
GS–					
142	15:4674	PC Ontario Ministry of Natural Resources, Public Information Centre, 99 Wellesley St., W, Toronto, ON, CAN M7A 1W3; MF CAN-MET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
142	15:5970	PC Ontario Ministry of Natural Resources, Public Information Centre, 99 Wellesley St., W, Toronto, ON, CAN M7A 1W3; MF CAN-MET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			

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GSI–					
89-69(prepr.)	15:5934	Available from Gesellschaft fuer Schwerionen-forschung m.b.H., Darmstadt (Germany, F.R.)			
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HHS/PUB/FDA–					
89-8221	15:5926	*See* PB–89-230742/XAB			
HQ–					
1988-AV	15:5230	PC Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, CAN H2Z 1A4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
1988-FV	15:5231	PC Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, CAN H2Z 1A4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
89-03180	15:5277	PC Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, CAN H2Z 1A4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
89-03211	15:5239	PC Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, CAN H2Z 1A4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
D89-0001	15:5278	PC Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, CAN H2Z 1A4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
D89-0009	15:5240	PC Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, CAN H2Z 1A4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
D89-0011	15:5279	PC Hydro-Quebec, Centre de diffusion, 75, boul. Dorchester ouest, 14e etage, Montreal, PQ, CAN H2Z 1A4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
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4552-11	15:5487	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610776	
4576-11	15:5488	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610777	
4685-2	15:6130	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90609292	
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254(Add.12)	15:4890	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610380	
254(Add.13)	15:4891	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610381	
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4580-F	15:5927	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90609897	
4658-F	15:4887	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610392	
4939-F	15:5895	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90609822	

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IAEA-TECDOC–					
508	15:5185	NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS		DE90610120	
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513	15:4759	NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS		DE90610069	
515	15:4893	NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS		DE90608568	
517	15:5186	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE90610211	
518	15:5108	NTIS (US Sales Only), PC A18/MF A01 - OSTI; INIS		DE90610351	
519	15:6295	NTIS (US Sales Only), PC A10/MF A01 - OSTI; INIS		DE90607368	
520	15:5544	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90607841	
530	15:5741	NTIS (US Sales Only), PC A15/MF A01 - OSTI; INIS		DE90610214	
531	15:6460	NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS		DE90610395	
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88/400	15:6042	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610675	
88/401	15:6043	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610676	
88/402	15:6044	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610677	
89/100	15:6246	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610473	
89/103	15:6315	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610619	
89/104	15:6247	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610418	
89/139	15:6081	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610496	
89/148	15:6060	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90609236	
89/151	15:6248	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610458	
89/161	15:6082	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610497	
89/163	15:6316	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610623	
89/165	15:6317	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610624	
89/169	15:5990	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610634	
89/174	15:6083	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610498	
89/175	15:6224	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610564	
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89/181	15:6250	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610419	
89/184	15:5991	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610645	
89/186	15:6251	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610460	
89/188	15:6252	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610420	
89/189	15:6253	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610421	
89/193	15:6254	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610422	
89/198	15:5992	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610636	
89/199	15:6255	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610474	
89/200	15:5993	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610638	

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89/208	15:6084	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610499	
89/210	15:6257	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610424	
89/213	15:6085	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610500	
89/219	15:5994	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610647	
89/220	15:6258	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610425	
89/221	15:5995	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610639	
89/222	15:5996	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610640	
89/225	15:6259	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610475	
89/227	15:6225	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610551	
89/229	15:6159	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610714	
89/240	15:6226	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610552	
89/241	15:6227	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610553	
89/243	15:6086	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610501	
89/247	15:6087	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610502	
89/248	15:6260	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610476	
89/262	15:6261	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610426	
89/265	15:6461	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610986	
89/267	15:5935	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610823	
89/269	15:6262	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610427	
89/270	15:6242	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610663	
89/271	15:6243	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610664	
89/279	15:6160	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610715	
89/280	15:6263	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610477	
89/284	15:6088	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610504	
89/285	15:6264	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610428	
89/291	15:6089	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610505	
89/293	15:6061	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610683	
89/299	15:5997	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610641	
89/300	15:6265	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610429	
89/301	15:6266	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610430	
89/302	15:6267	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610431	
89/303	15:6268	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610432	
89/305	15:6269	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610433	
89/307	15:6270	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610461	
89/311	15:6271	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610434	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
89/91	15:6158	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610701	
9192	15:4648	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877			
9205	15:4634	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877			
9207	15:4649	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877			
9208	15:4581	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877			
9209	15:4650	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877			
IEACR–					
18	15:4592	IEA Coal Research, 14-15 Lower Grosvenor Place, London, SW 1W OEX, England			
IEN-DERE-DIMEC–					
001/89	15:6474	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608884	
002/89	15:6462	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608890	
IEN-DERE-DITRA–					
01/89	15:5652	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608606	
IEPA/LPC–					
89/011	15:5361	*See* PB–89-235972/XAB			
IFE/KR/E–					
89/003	15:5109	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610352	
IFVE-OTF–					
88-202	15:6272	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90608906	
88-208	15:6090	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608915	
88-212	15:6273	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608907	
IFVE-OUNK–					
87-173	15:5428	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610761	
IGT–					
61095	15:4565	*See* DOE/PC/88891–T2			
ILWRP–					
86-P10	15:4777	*See* DOE-RW–89.048			
IM–					
2243	15:5429	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610758	
2258	15:5430	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610759	
INCT–					
2021/8/E/B	15:5551	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610731	
INDC(CCP)–					
304/L	15:6103	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90609270	
INDC(INS)–					
001	15:5116	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610959	
INDC(NDS)–					
223/GF	15:6363	NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS		DE90609134	
INFN-AE–					
89-2	15:5719	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610939	
INFN-LNF–					
89-018(R)	15:5720	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610941	
89-020(RT)	15:6091	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610506	
89-044(R)	15:5729	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610948	
89/043(PT)	15:6092	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90608916	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
INIS-BR–					
1684	15:5168	NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS		DE90608647	
1687	15:5855	NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS		DE90608124	
1690	15:4989	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610153	
1692	15:5909	NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS		DE90609966	
1693	15:5260	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608856	
1694	15:5753	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610294	
1696	15:5020	NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS		DE90610950	
1697	15:5021	NTIS (US Sales Only), PC A13/MF A01 - OSTI; INIS		DE90608699	
1704	15:5856	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90609798	
1705	15:5117	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE90608648	
1707	15:5022	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608700	
1709	15:5023	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608649	
1711	15:5171	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90608650	
1712	15:5187	NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS		DE90608657	
1716	15:5118	NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS		DE90608651	
1739	15:5915	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90608885	
1742	15:5110	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610353	
1746	15:5119	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE90608652	
1751	15:5754	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610217	
1752	15:5489	NTIS (US Sales Only), PC A16/MF A01 - OSTI; INIS		DE90608004	
1753	15:5500	NTIS (US Sales Only), PC A08/MF A01 - OSTI; INIS		DE90608019	
1756	15:5755	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90608813	
1757	15:5159	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608323	
1758	15:4784	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608843	
1763	15:4587	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608986	
INIS-SU–					
135/A	15:5433	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90705985	
INIS-mf–					
11539	15:4892	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608874	
11541	15:6463	NTIS (US Sales Only), PC A01/MF A01 - OSTI; INIS		DE90608901	
11542	15:5552	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90609294	
11556	15:6453	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608902	
11559	15:6454	NTIS (US Sales Only), PC A06/MF A01 - OSTI; INIS		DE90608903	
11563	15:4992	NTIS (US Sales Only), PC A99/MF A01 - OSTI; INIS		DE90608686	
11564	15:5038	NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS		DE90705979	
INP–					
1301/PH	15:6108	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610721	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
1303/PH	15:6109	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE90610722	
1304/PL	15:6274	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610435	
1305/PS	15:6025	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610539	
1307/PH	15:6171	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610708	
1308/PL	15:6172	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610716	
1309/PS	15:6230	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610600	
1310/AP	15:5870	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90610785	
1311/PH	15:6173	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610709	
1312/PS	15:6026	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610540	
1313/PL	15:6119	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610724	
1314/D	15:6211	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610866	
1316/PS	15:6027	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610541	
1317/PS	15:6028	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610542	
1320/AP	15:5871	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610786	
1321/B	15:5945	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610830	
1322/PH	15:6110	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610723	
1323/PS	15:6029	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE90610544	
1325/AP	15:5872	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610787	
1329/B	15:5193	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610862	
1330/B	15:5873	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610783	
1332/B	15:6212	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610873	
1333/PS	15:6030	NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS		DE90610545	
IOM-TM–					
89-02	15:4651	Institute of Occupational Medicine, Edinburgh (UK)			
89-05	15:4652	Institute of Occupational Medicine, Edinburgh (UK)			
IPJ–					
2018/ZDAJ/PL/B	15:5708	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610934	
IPNO-TH–					
89-19	15:6062	NTIS (US Sales Only), PC A03/MF A01		DE90727321	
89-23	15:6063	NTIS (US Sales Only), PC A03/MF A01		DE90727322	
IPP–					
1/247	15:6318	NTIS (US Sales Only), PC A03/MF A01		DE90728986	
1/248	15:6319	NTIS (US Sales Only), PC A03/MF A01		DE90728987	
2/301	15:6320	NTIS (US Sales Only), PC A03/MF A01		DE90729148	
6/257	15:6093	NTIS (US Sales Only), PC A03/MF A01		DE90729142	
6/282	15:6321	NTIS (US Sales Only), PC A03/MF A01		DE90729147	
III/146	15:6322	NTIS (US Sales Only), PC A03/MF A01		DE90728988	
III/149	15:5602	NTIS (US Sales Only), PC A03/MF A01		DE90729144	
III/150	15:6323	NTIS (US Sales Only), PC A05/MF A01		DE90729146	
III/151	15:6324	NTIS (US Sales Only), PC A10/MF A01		DE90729151	
IREQ–					
046D549	15:5217	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
174T703	15:5215	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRIES UPON REQUEST CAN			
217D503	15:5218	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN			
IRF–					
201	15:6014	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE90610822	
ISI/RR–					
89-223	15:5815	*See* AD-A–211314/0/XAB			
89-225	15:5816	*See* AD-A–211325/6/XAB			
ITE–					
1085	15:5194	British Library Document Supply Centre, Boston Spa, Wetherby. West Yorks. LS23 7BQ			
IWGFPT–					
32	15:5129	NTIS (US Sales Only), PC A14/MF A01 - OSTI; INIS		DE90610159	
IWGGCR–					
19	15:5078	NTIS (US Sales Only), PC A09/MF A01 - OSTI; INIS		DE90608752	
IYaF–					
88-129	15:6031	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90608945	
88-98	15:5797	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610312	
89-1	15:6094	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90608917	
JINR-R–					
1-88-504	15:5769	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610966	
11-88-451	15:6276	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610436	
11-88-452	15:6277	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610437	
11-88-453	15:6278	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610438	
11-88-598	15:6279	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610439	
11-88-599	15:6280	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610440	
14-88-477	15:6244	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610665	
17-88-436	15:6281	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610462	
17-88-478	15:6231	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610565	
17-88-576	15:6282	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610463	
17-88-630	15:6095	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610507	
19-87-215	15:5946	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610826	
2-88-373	15:6275	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610441	
2-88-654	15:5998	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610648	
2-88-657	15:6064	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90610685	
6-88-580	15:6032	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90610546	
Juel–					
2279	15:6283	Available from Kernforschungsanlage Juelich GmbH (Germany, F.R.). Zentralbibliothek		DE90728790	
2284	15:5515	Available from Kernforschungsanlage Juelich GmbH (Germany, F.R.). Zentralbibliothek			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
K/CSD/INF–					
89/5	15:5655	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89011620	MF-706
K/DSRD–					
112-Vol.1	15:6476	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003698	
K/ETO–					
4	15:4752	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003473	MF-517
K/QT–					
279	15:6045	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89015730	MF-506
KCP–					
613-4145	15:5359	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002926	MF-706
613-4206	15:6475	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002966	MF-706
KFK–					
4520	15:5834	NTIS (US Sales Only), PC A03/MF A01		DE90729137	
4594	15:5443	NTIS (US Sales Only), PC A03/MF A01		DE90728839	
4595	15:5665	NTIS (US Sales Only), PC A03/MF A01		DE90728841	
4608	15:6367	NTIS (US Sales Only), PC A05/MF A01		DE90728840	
4611	15:5656	NTIS (US Sales Only), PC A07/MF A01		DE90728837	
4620	15:5444	NTIS (US Sales Only), PC A03/MF A01		DE90729149	
4628	15:5501	NTIS (US Sales Only), PC A08/MF A01		DE90729150	
LA–					
11606-MS	15:6477	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003648	MF-705
11681-MS	15:6478	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003247	MF-705
LA-UR–					
89-1834	15:5631	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012631	MF-706
89-2309	15:5632	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89015270	MF-705
89-2342	15:5633	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89015265	
89-2430	15:5517	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89015251	MF-704
89-2467	15:5804	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89015303	MF-741
89-2546	15:4683	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89015287	MF-930
89-2595	15:5634	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89015275	
89-3538	15:5770	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002417	MF-706
89-3546	15:5518	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002416	MF-904
89-3582	15:4684	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002411	MF-903
89-3615	15:5721	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002418	MF-414
89-3684	15:5398	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003392	MF-900
89-3687	15:6325	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003390	MF-426
89-3701	15:4786	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003169	MF-940
89-3702	15:4787	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003168	MF-810
89-3713	15:5709	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003167	MF-414
89-3721	15:5446	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003192	MF-704
89-3734	15:4788	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003190	MF-814
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89-4030	15:6097	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003222	MF-414
LAFI–					
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142	15:5516	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90609781	
143	15:6285	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608905	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
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26069	15:5324	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003268	MF-350; MF-920
26070	15:5325	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003276	MF-350
26455	15:5403	NTIS, PC A11/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003301	PC-400
26946	15:5284	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002615	MF-600
27047	15:6066	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000553	MF-414
27070	15:6492	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003269	MF-405
27210	15:5326	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002611	PC-350
27222	15:4916	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002616	MF-600
27578	15:4791	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000556	MF-403
27658	15:5327	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002599	MF-350
27660	15:5798	NTIS, PC A10/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002613	PC-600
27690	15:6174	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003939	MF-414
27745	15:5689	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002671	MF-406
27774	15:5448	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003280	MF-404
27850	15:6033	NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003123	MF-411
LPC–					
61-1424-9-88	15:5328	PC New Brunswick Legislative Library, Government Documents Section, 766 King Street, Fredericton, NB, CAN E3B 5H1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
LUIP–					
8812	15:6124	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610725	
LUNFD6-NFFK–					
7095-1-24-1988	15:6124	*See* LUIP–8812			
LYCEN–					
88-28	15:6034	NTIS (US Sales Only), PC A03/MF A01		DE90727352	
MEA–					
2265	15:5070	*See* NUREG/CR–5327			
2325	15:5123	*See* NUREG/CR–5188			
MICROLOG–					
87-04066	15:5897	*See* OME/WRB–87-04066-Vol.2			
87-06347	15:5898	*See* OME/WRB–87-04066-Vol.3			
87-06347	15:5899	*See* OME/WRB–87-06347-Vol.2			
89-00495	15:5258	*See* EMR/ER–8805			
89-02096	15:5328	*See* LPC–61-1424-9-88			
89-02165	15:4582	*See* ARC–89-02165-3			
89-02165	15:4588	*See* PDE–89-02165-2			
89-02165	15:4743	*See* WU/WCP–89-02165-1			
89-02371	15:5268	*See* RAC–89-02371			
89-02396	15:5880	*See* SSC/TLB–S52-2-183			
89-02696	15:5298	*See* AMA–89-02696			
89-02699	15:5299	*See* AMA–89-02699			
89-02740	15:4699	*See* AI/N–89-02740			
89-02875	15:4919	*See* QMA–89-02875			
89-02896	15:4704	*See* TC–T1-8-1988			
89-02966	15:5252	*See* RCP–61087-Pt.1			
89-02966	15:5253	*See* RCP–61087-Pt.2			
89-03131	15:5237	*See* QAERC–760/821			
89-03171	15:5230	*See* HQ–1988-AV			
89-03171	15:5231	*See* HQ–1988-FV			
89-03174	15:5278	*See* HQ–D89-0001			
89-03175	15:5279	*See* HQ–D89-0011			
89-03176	15:5240	*See* HQ–D89-0009			
89-03180	15:5277	*See* HQ–89-03180			
89-03211	15:5239	*See* HQ–89-03211			
89-03241	15:5329	*See* NRC–29348E			
89-03242	15:5334	*See* NRC–29348F			
89-03253	15:5451	*See* NRCC/IMR–29708			
89-03259	15:5929	*See* NRC–29197			
89-03520	15:5373	*See* MMCL–89-03520			
89-03535	15:5520	*See* NAE–30057			

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89-03549	15:5637	*See* NRC/ACP–89-03549			
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89-03645	15:5892	*See* EC/IWD–156			
89-03698	15:5353	*See* AC/CB–1775/E			
89-03720	15:5241	*See* NTRR–89-03720			
89-03735	15:5238	*See* EC–CCD88-06			
89-03789	15:5265	*See* APUB–89-03789			
89-03831	15:4923	*See* CE/IWD–89-03831			
89-03864	15:5283	*See* YG/BS–89-03864			
89-03920	15:5323	*See* ETDE/GA-MS–M91-7/45-1989E			
89-03922	15:5322	*See* ETDE/CA-MS–M91-7/44-1989E			
89-03949	15:4697	*See* PCPP/R–89-03949			
89-03960	15:5849	*See* CPS–EPS3/HA/5			
89-04004	15:4674	*See* GS–142			
89-04004	15:5970	*See* GS–142			
89-04017	15:5635	*See* NBU/ME–TP8422E			
89-04065	15:5350	*See* QU/CIGGT–88-6			
89-04397	15:4679	*See* NDE–89-04397			
MMCL–					
89-03520	15:5373	PC New Brunswick Dept. of Natural Resources and Energy, P.O. Box 6000, Fredericton, NB, CAN E3B 5H1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
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89/0005	15:4701	*See* PB–89-234892/XAB			
89/0053	15:4702	*See* PB–89-234900/XAB			
MPI-PAE/Exp.El.–					
207	15:5771	Available from Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik			
209	15:5772	Available from Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (Germany, F.R.). Werner-Heisenberg-Inst. fuer Physik			
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1156	15:4635	NTIS, PC A03/MF A01 - OSTI		DE90003744	
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1159	15:4655	NTIS, PC A13/MF A01 - OSTI		DE90003736	
1160	15:4656	NTIS, PC A20/MF A01 - OSTI		DE90003739	
1161	15:4657	NTIS, PC A06/MF A01 - OSTI		DE90003740	
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1167	15:4661	NTIS, PC A21/MF A01 - OSTI		DE90003734	
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1194	15:4637	NTIS, PC A03/MF A01 - OSTI		DE90003746	
90003751	15:4665	NTIS, PC A07/MF A01 - OSTI		DE90003751	
9003752	15:4664	NTIS, PC A07/MF A01 - OSTI		DE90003752	
MTL-TR–					
89-41	15:5468	*See* AD-A–211308/2/XAB			
89-71	15:5473	*See* AD-A–211742/2/XAB			
MTR–					
7966	15:5923	NTIS, PC A07/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003528	MF-407
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89-17214	15:5690	NTIS, PC A03/MF A01			
89-25818	15:6000	NTIS, PC A04/MF A01			
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89-26900	15:5673	NTIS, PC A05/MF A01			
89-27612	15:6001	NTIS, PC A03/MF A01			
89-27818	15:5449	NTIS, PC A05/MF A01			
89-27868	15:4930	NTIS, PC A03/MF A01			
89-27980	15:5674	NTIS, PC A03/MF A01			
NAC–					
88-14	15:5924	the National Accelerator Centre, Council for Scientific and Industrial Research, P.O. Box 72, Faure, 7131, South Africa			

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NAE–					
30057	15:5520	PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
NAS–					
1.15:102103	15:4930	*See* N–89-27868			
1.15:102294	15:5674	*See* N–89-27980			
1.26:182275	15:5672	*See* N–89-26899			
1.26:183715	15:5673	*See* N–89-26900			
1.26:184589	15:5690	*See* N–89-17214			
1.26:4253	15:5449	*See* N–89-27818			
1.61:1229	15:6001	*See* N–89-27612			
1.83:106	15:6000	*See* N–89-25818			
NASA-CR–					
182275	15:5672	*See* N–89-26899			
183715	15:5673	*See* N–89-26900			
184589	15:5690	*See* N–89-17214			
4253	15:5449	*See* N–89-27818			
NASA-RP–					
1229	15:6001	*See* N–89-27612			
NASA-TM–					
102103	15:4930	*See* N–89-27868			
102294	15:5674	*See* N–89-27980			
NBU/ME–					
TP8422E	15:5635	PC Transport Canada, Library and Information Centre, Place de Ville, Tower C, Ottawa, ON, CAN K1A 0N5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
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ND-R–					
1381(D)	15:5636	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90610083	
1543(W)	15:4777	*See* DOE-RW–89.048			
910(S)	15:6233	H.M. Stationery Office, London, price Pound 8.00			
NDE–					
89-04397	15:4679	PC Newfoundland and Labrador Dept. of Mines and Energy, Geological Survey Branch, PO Box 8700, St. John's, NF, CAN A1B 4J6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
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NEDOJ-P–					
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8816	15:4960	NTIS (US Sales Only), PC A06/MF A01		DE90725119	
8824	15:4961	NTIS (US Sales Only), PC A11		DE90725121	
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94	15:6213	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90609948	
95	15:6214	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90609949	
96	15:5169	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610396	
97	15:5170	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610397	
99	15:6464	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE90610987	

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68/88	15:6215	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610874	
NIPER–					
436	15:4685	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003759	MF-122
445	15:4686	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003758	MF-122
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89/4145	15:5840	*See* PB–89-228977/XAB			
NKS–					
88-3	15:6465	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610415	
NMAB–					
457	15:5355	*See* DOE/CE/40625–T1			
NPL-RS(EXT)–					
112	15:5773	the British Library Document Supply Centre, Boston Spa, Wetherby, West Yorks. LS23 7BQ			
NPS–					
56-89-010	15:5397	*See* AD-A–211349/6/XAB			
NRC–					
29197	15:5929	PC Canadian Forestry Service, Government of Canada, 351 St. Joseph Boulevard, Hull, PQ, CAN K1A 1G5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
29348E	15:5329	PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
29348F	15:5334	PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
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29708	15:5451	PC National Research Council of Canada, Publication Sales and Distribution Office, Montreal Road, Ottawa, ON, CAN K1A 0R6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
NRL-MR–					
6508	15:5620	*See* AD-A–211580/6/XAB			
NSS/R–					
153	15:4792	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610335	
154	15:4793	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610336	
NTRR–					
89-03720	15:5241	PC Northwest Territories. Dept. of Renewable Resources, P.O. Box 1320, Yellowknife, NT, CAN X1A 2L9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			

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NUREG–					
0386-Digest-5-Rev.2	15:5106	NTIS, PC A99/MF A01 - GPO; OSTI; INIS		TI90002836	
0823-Suppl.1	15:5196	NTIS, PC A04/MF A01 - GPO; OSTI; INIS		TI90002831	
1379	15:6493	NTIS, PC A04/MF A01 - GPO; OSTI; INIS		TI90002913	
NUREG/CR–					
2000-Vol.8-No.9	15:5197	NTIS, PC A07/MF A01 - GPO; OSTI; INIS		TI90002912	
4639-Vol.4-Pt.1-Rev.1	15:5198	NTIS, PC A03/MF A01 - GPO - OSTI		TI90002960	
4639-Vol.4-Pt.2-Rev.1	15:5199	NTIS, PC A07/MF A01 - GPO - OSTI		TI90002959	
4639-Vol.4-Pt.3-Rev.1	15:5200	NTIS, PC A11/MF A01 - GPO - OSTI		TI90002961	
5184	15:4794	NTIS, PC A07/MF A01 - GPO - OSTI		TI90003540	
5188	15:5123	NTIS, PC A10/MF A01 - GPO - OSTI		TI90003844	
5323	15:5201	NTIS, PC A07/MF A01 - GPO; OSTI; INIS		TI90002674	
5327	15:5070	NTIS, PC A04/MF A01 - GPO; OSTI; INIS		TI90002601	
5341	15:5202	NTIS, PC A20/MF A01 - GPO; OSTI; INIS		TI90002911	
5406-Vol.1	15:5203	NTIS, PC A03/MF A01 - GPO; OSTI; INIS		TI90002917	
5406-Vol.2	15:5006	NTIS, PC A99/MF A01 - GPO; OSTI; INIS		TI90002924	
5406-Vol.3	15:5204	NTIS, PC A03/MF A01 - GPO; OSTI; INIS		TI90002918	
5412	15:4795	NTIS, PC A02/MF A01 - GPO; OSTI; INIS		TI90003760	
5417	15:5971	NTIS, PC A03/MF A01; OSTI; INIS		TI90003163	
5420	15:5205	NTIS, PC A06/MF A01 - GPO; OSTI; INIS		TI90002687	
5422	15:5150	NTIS, PC A04/MF A01 - GPO; OSTI; INIS		TI90002986	
5470	15:5206	NTIS, PC A07/MF A01 - GPO; OSTI; INIS		TI90002985	
OCS/MMS–					
88/0089	15:4680	*See* PB–89-128227/XAB			
ODMWG/P–					
(88)13	15:5158	*See* CEGB-RD/B–6079/R88			
(88)9	15:6189	*See* CEGB-RD/B–6077/R88			
OITS–					
401	15:6058	*See* DOE/ER/40224–92			
405	15:6053	*See* DOE/ER/40224–96			
414	15:6078	*See* DOE/ER/40224–105			
OME/WRB–					
87-04066-Vol.2	15:5897	PC Ontario Ministry of the Environment, Public Information Office, 135 St. Clair Ave. West, Toronto, ON, CAN M4V 1P5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
87-04066-Vol.3	15:5898	PC Ontario Ministry of the Environment, Public Information Office, 135 St. Clair Ave. West, Toronto, ON, CAN M4V 1P5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
87-06347-Vol.2	15:5899	PC Ontario Ministry of the Environment, Public Information Office, 135 St. Clair Ave. West, Toronto, ON, CAN M4V 1P5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
ORF–					
TE-87-12	15:5389	Energy, Mines and Resources Canada, Communications Branch, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: N/C			
ORNL/FTR–					
3417	15:6111	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002484	MF-413
3431	15:5947	NTIS, PC A03/MF A01 - OSTI		DE90003202	MF-407
3432	15:5835	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003285	MF-402; MF-408
3435	15:5103	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002962	MF-400
3456	15:5452	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002658	MF-406
3466	15:5774	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002920	MF-414
3468	15:5836	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003283	MF-402

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
3470	15:5124	NTIS, PC A03/MF A01 - OSTI		DE90003522	
3472	15:4577	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003200	MF-108
3474	15:5775	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003479	MF-414
3478	15:5233	NTIS, PC A04/MF A01 - OSTI		DE90003381	MF-400
3480	15:5776	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003590	MF-400
3481	15:5777	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003477	MF-413
3482	15:5907	NTIS, PC A03/MF A01 - OSTI		DE90003380	MF-408
3483	15:5837	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003476	MF-602
3484	15:5925	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003198	MF-408
3485	15:6035	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003592	MF-401
3489	15:6175	NTIS, PC A03/MF A01 - OSTI		DE90003628	MF-413
3493	15:5339	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003521	MF-350
ORNL/M–					
947	15:5951	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003199	MF-600
ORNL/NOAC–					
234	15:5205	*See* NUREG/CR–5420			
ORNL/NSIC–					
200-Vol.8-No.9	15:5197	*See* NUREG/CR–2000-Vol.8-No.9			
ORNL/RASA–					
88/37	15:5874	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003519	MF-511
88/43	15:5875	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003475	MF-511
88/90	15:5876	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003474	MF-511
89/28	15:5877	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003430	MF-511
ORNL/Sub–					
89-AJ015GA1/1	15:4796	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90004418	MF-707
ORNL/TM–					
10831	15:4794	*See* NUREG/CR–5184			
11173	15:5372	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90004352	
11292	15:4797	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003378	MF-510
11293	15:4798	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003379	MF-510
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89-02	15:6067	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90609240	
89-05	15:6015	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90609834	
89-06	15:6098	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610508	
89-08	15:6368	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610627	
89-09	15:6466	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90610416	
89-12	15:6068	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90609241	
89-13	15:6069	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90609242	
89-14	15:5778	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610967	
89-15	15:6070	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90609237	
89-16	15:6127	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610727	
89-17	15:6071	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610679	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
PATENTS-USA–					
4,865,625	15:4693	Patent and Trademark Office, Box 9, Washington, DC 20232			
4,866,147	15:4694	Patent and Trademark Office, Box 9, Washington, DC 20232			
PB–					
89-128227/XAB	15:4680	NTIS, PC A14/MF A01			
89-137772/XAB	15:5952	NTIS, PC E05/MF A01			
89-218762/XAB	15:5340	NTIS, PC A03/MF A01			
89-219604/XAB	15:5280	NTIS, PC A09/MF A01			
89-219976/XAB	15:4700	NTIS, PC A04/MF A01			
89-220909/XAB	15:5972	NTIS, PC A03/MF A01			
89-221238/XAB	15:5838	NTIS, PC A03/MF A01			
89-224083/XAB	15:5878	NTIS, PC A08/MF A01			
89-224489/XAB	15:5839	NTIS, PC A03/MF A01			
89-224968/XAB	15:5236	NTIS, PC A04/MF A01			
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89-227060/XAB	15:4578	NTIS, PC A99			
89-228977/XAB	15:5840	NTIS, PC A07/MF A01			
89-229843/XAB	15:5385	NTIS, PC A07/MF A01			
89-230221/XAB	15:5962	NTIS, PC A03/MF A01			
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89-232201/XAB	15:5242	NTIS, PC EE99/MF E99			
89-232219/XAB	15:5243	NTIS, PC A05/MF A01			
89-232227/XAB	15:5244	NTIS, PC A24/MF A01			
89-232235/XAB	15:5245	NTIS, PC A99/MF E04			
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89-233571/XAB	15:4983	NTIS, PC A06/MF A01			
89-234066/XAB	15:4666	NTIS, PC A03/MF A01			
89-234074/XAB	15:4667	NTIS, PC A03/MF A01			
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89-235170/XAB	15:5360	NTIS, PC A06/MF A01			
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89-237978/XAB	15:5364	NTIS, PC A02/MF A01			

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89-238240/XAB	15:4668	NTIS, PC A02/MF A01			
89-238265/XAB	15:4669	NTIS, PC A03/MF A01			
89-868103/XAB	15:5900	NTISPC N01/MF N01			
89-871677/XAB	15:5806	NTISPC N01/MF N01			
89-872444/XAB	15:4799	NTISPC N01/MF N01			
89-872451/XAB	15:4596	NTISPC N01/MF N01			
89-873046/XAB	15:5349	NTISPC N01/MF N01			
89-873095/XAB	15:4972	NTISPC N01/MF N01			
89-873103/XAB	15:4973	NTISPC N01/MF N01			
89-873392/XAB	15:5555	NTISPC N01/MF N01			
89-873434/XAB	15:5365	NTISPC N01/MF N01			
89-873475/XAB	15:5453	NTISPC N01/MF N01			
89-873483/XAB	15:5454	NTISPC N01/MF N01			
89-873632/XAB	15:5956	NTISPC N01/MF N01			
89-873723/XAB	15:4556	NTISPC N01/MF N01			
89-873731/XAB	15:5229	NTISPC N01/MF N01			
89-873954/XAB	15:5603	NTISPC N01/MF N01			
89-873988/XAB	15:5641	NTISPC N01/MF N01			
PCMRP–					
87-P8	15:4878	*See* AERE-R–12902			
PCPP/R–					
89-03949	15:4697	PC Petro-Canada, P.O. Box 2844, Calgary, AB, CAN T2P 3E3; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
PDE–					
89-02165-2	15:4588	PC Canada Centre for Mineral and Energy Technology, Technical Information Division, 562 Booth St., Room 20C, Ottawa, ON, CAN K1A 0G1; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
PMA–					
CE-02772	15:4698	Petroleum Monitoring Agency, 580 Booth St., Ottawa, ON, CAN K1A 0E4. Prices: N/C			
PNL–					
6986	15:5341	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003428	MF-350
6991	15:5342	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003016	MF-350
7121	15:4800	NTIS, PC A09/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002630	MF-510
7139	15:5222	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90004437	MF-202
7141	15:5223	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90004436	MF-202
7153	15:4801	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003401	MF-510
7173	15:5282	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003164	MF-920
PNL-SA–					
15982	15:6467	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90002657	MF-500
16112	15:5556	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003637	MF-506
16838	15:5905	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002664	MF-507
16867	15:5957	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002896	MF-600
16885	15:5668	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002735	MF-312
17100	15:5901	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002724	MF-500
17179	15:5964	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002662	MF-507
17239	15:6455	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002731	MF-500; MF-506
17327	15:5521	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003633	MF-401
17355	15:5642	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002730	MF-500
17432	15:5455	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002729	MF-506
17459	15:4974	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002672	MF-261
17603	15:6480	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003513	MF-505
17607	15:5522	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003638	MF-404
PPPL–					
2661	15:6327	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003427	PC-420; PC-421
PWR-CWG-P–					
(85)347	15:4876	*See* AEEW-M–2253			
PWR/ASG/P–					
(87)5	15:5008	*See* CEGB-RD/B–6056/R88			
PWR/CWG/P–					
(87)534	15:5008	*See* CEGB-RD/B–6056/R88			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
PWR/HTWG/P–					
(88)622	15:5010	*See* CEGB-RD/L–3369/R88			
PWR/PKWG/P–					
(88)350	15:5011	*See* CEGB-RD/M–1717/RR88			
PWRRC-TR–					
181	15:5972	*See* PB–89-220909/XAB			
QAERC–					
760/821	15:5237	PC Quebec (Province). Ministere de l'agriculture, des pecheries et de l'alimentation, 200A, chemin Ste-Foy, Quebec, PQ, CAN G1R 4X6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $2.00 CAN; MF $10 CAN			
QMA–					
89-02875	15:4919	PC Quebec (Province). Ministere de l'agriculture, des pecheries et de l'alimentation, 200A, chemin Ste-Foy, Quebec, PQ, CAN G1R 4X6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC $2.00 CAN; MF $10 CAN			
QU/CIGGT–					
85-6	15:5350	PC Transport Canada, Library and Information Centre, Place de Ville, Tower C, Ottawa, ON, CAN K1A 0N5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
RAC–					
89-02371	15:5268	PC Ontario Ministry of the Environment, Public Information Office, 135 St. Clair Ave. West, Toronto, ON, CAN M4V 1P5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
RAL–					
89-051	15:6072	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90609243	
89-055	15:6328	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE90609071	
89-066	15:6073	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90609244	
89-076	15:6099	NTIS (US Sales Only), PC A02/MF A01 - OSTI		DE90000522	
RAND/N–					
2511-AF	15:5402	*See* AD-A–211393/4/XAB			
RCP–					
61087-Pt.1	15:5252	PC Manitoba Hazardous Waste Management Corporation, 226-530 Century Street, Winnipeg, MB, CAN R3H 0Y4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
61087-Pt.2	15:5253	PC Manitoba Hazardous Waste Management Corporation, 226-530 Century Street, Winnipeg, MB, CAN R3H 0Y4; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			
REPT–					
89B00238	15:6001	*See* N–89-27612			
RFP–					
4380	15:5841	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003761	MF-702
RHO-BW-ST–					
51P	15:4866	OSTI; INIS		TI90003828	MF-813
RHO-BWI-DP–					
039	15:4802	OSTI; INIS		TI90003866	MF-813
041	15:4803	OSTI; INIS		TI90003584	MF-813
042	15:4804	OSTI; INIS		TI90003832	MF-813
043	15:4805	OSTI; INIS		TI90003869	MF-813

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045-Rev.1	15:4806	OSTI; INIS		TI90003870	MF-813
048	15:4807	OSTI		TI90003871	MF-813
049	15:4808	OSTI		TI90003872	MF-813
050	15:4809	OSTI; INIS		TI90003873	MF-813
051	15:4810	OSTI; INIS		TI90003583	MF-813
052	15:4811	OSTI; INIS		TI90003875	MF-813
055	15:4812	OSTI		TI90003879	MF-813
059	15:4813	OSTI; INIS		TI90003864	MF-813
064	15:4814	OSTI; INIS		TI90003831	MF-813
RHO-BWI-ER–					
010	15:4815	OSTI; INIS		TI90003835	MF-813
RHO-BWI-ES–					
015	15:4816	OSTI		TI90003857	MF-813
016	15:4817	OSTI; INIS		TI90003854	MF-813
021	15:4818	OSTI; INIS		TI90003851	MF-813
RHO-BWI-PD–					
012	15:4819	OSTI; INIS		TI90003580	MF-813
015	15:4820	OSTI; INIS		TI90003582	MF-813
RHO-BWI-SA–					
123	15:4821	OSTI; INIS		TI90003833	MF-813
RHO-BWI-SD–					
005-Vol.2	15:4822	OSTI; INIS		TI90003859	MF-813
RHO-BWI-TA–					
006	15:4823	OSTI; INIS		TI90003849	MF-813
007-Rev.1	15:4824	OSTI		TI90003850	MF-813
013	15:4825	OSTI; INIS		TI90003853	MF-813
RHO-BWI-TD–					
012	15:4826	OSTI; INIS		TI90003581	MF-813
RHO-BWI-TI–					
023	15:4827	OSTI; INIS		TI90003463	MF-813
089	15:4828	OSTI; INIS		TI90003456	MF-813
095	15:4829	OSTI; INIS		TI90003466	MF-813
102	15:4830	OSTI; INIS		TI90003468	MF-813
105	15:4831	OSTI; INIS		TI90003467	MF-813
177	15:4832	OSTI; INIS		TI90003462	MF-813
190	15:4833	OSTI; INIS		TI90003410	MF-813
202	15:4834	OSTI; INIS		TI90003414	MF-813
203	15:4835	OSTI; INIS		TI90003415	MF-813
226-Rev.1	15:4836	OSTI; INIS		TI90003469	MF-813
226-Rev.1	15:4837	OSTI; INIS		TI90003413	MF-813
227	15:4838	OSTI; INIS		TI90003412	MF-813
228	15:4839	OSTI; INIS		TI90003438	MF-813
229	15:4840	OSTI; INIS		TI90003439	MF-813
230	15:4841	OSTI; INIS		TI90003411	MF-813
232	15:4842	OSTI; INIS		TI90003458	MF-813
233	15:4843	OSTI; INIS		TI90003437	MF-813
234	15:4844	OSTI; INIS		TI90003416	MF-813
235	15:4845	OSTI; INIS		TI90003417	MF-813
238	15:4846	OSTI; INIS		TI90003418	MF-813
247	15:4847	OSTI; INIS		TI90003419	MF-813
249	15:4848	OSTI; INIS		TI90003435	MF-813
253	15:4849	OSTI; INIS		TI90003436	MF-813
254	15:4850	OSTI; INIS		TI90003434	MF-813
256	15:4851	OSTI; INIS		TI90003426	MF-813
257	15:4852	OSTI; INIS		TI90003425	MF-813
258	15:4853	OSTI; INIS		TI90003424	MF-813
262	15:4854	OSTI; INIS		TI90003423	MF-813
263	15:4855	OSTI; INIS		TI90003422	MF-813
265	15:4856	OSTI; INIS		TI90003459	MF-813
276	15:4857	OSTI; INIS		TI90003465	MF-813
303	15:4858	OSTI; INIS		TI90003461	MF-813
RHO-BWI-TRP–					
004	15:4859	OSTI; INIS		TI90003829	MF-813
RHO-BWI-TS–					
008	15:4860	OSTI; INIS		TI90003830	MF-813
012	15:4861	OSTI; INIS		TI90003722	MF-813
RHO-BWI-TY–					
001	15:4862	OSTI; INIS		TI90003585	MF-813
RHO-BWI-VP–					
002	15:4863	OSTI; INIS		TI90003408	MF-813
005	15:4864	OSTI; INIS		TI90003409	MF-813

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
010380-01-Rev.1	15:4865	OSTI; INIS		TI90003407	MF-813
RI–					
9206	15:4670	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877			
9207	15:4671	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877			
9209	15:4638	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877			
9214	15:4672	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877			
9218	15:4673	US General Accounting Office, PO Box 6015, Gaithersburg, MD 20877			
RISO-M–					
2771	15:6369	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610629	
2782	15:6468	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610991	
2786	15:6469	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90610993	
2790	15:5557	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610737	
2791	15:5604	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610742	
2792	15:5558	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610738	
RISO-R–					
563	15:5879	NTIS (US Sales Only), PC A07/MF A01 - OSTI; INIS		DE90610852	
RTI–					
4126	15:4690	*See* DOE/ER/13843–1			
RTR–					
2661	15:5207	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000597	MF-702
SAND–					
88-3231C	15:4975	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009570	MF-261
89-0246C	15:4954	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014742	MF-236
89-0247C	15:4955	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89014743	MF-236
89-0349	15:5202	*See* NUREG/CR–5341			
89-0536	15:4867	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003307	MF-721
89-0597C	15:5669	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002906	MF-706
89-0598C	15:5670	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002891	MF-706
89-0607C	15:5643	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89016529	MF-705; MF-706
89-0612C	15:5671	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002584	MF-706
89-0623	15:5351	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001803	MF-706
89-0685C	15:5523	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002908	MF-401
89-0965C	15:5559	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001502	MF-701
89-1008	15:5807	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003069	MF-706
89-1118C	15:6036	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002578	MF-700
89-1238C	15:4709	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001503	MF-123
89-1318C	15:4579	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002577	MF-701
89-1472C	15:5799	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002580	MF-706
89-1521	15:4795	*See* NUREG/CR–5412			
89-1607C	15:5524	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90000789	MF-704
89-1612C	15:6112	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003485	MF-706
89-1653C	15:5525	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003575	MF-704
89-1723C	15:5506	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003838	MF-704
89-1727C	15:5507	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003840	MF-704
89-1764C	15:5456	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003484	MF-706
89-1820C	15:5526	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89015391	MF-704
89-1913C	15:5802	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003514	MF-700
89-2109C	15:5692	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002905	MF-706
89-2206	15:6494	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003186	MF-706
89-2259	15:5693	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002645	MF-900
89-2536C	15:6286	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003339	MF-704
89-2604C	15:6047	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002892	MF-706
89-2767C	15:5527	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003155	
89-2793C	15:5508	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003579	MF-704
89-7111	15:6370	NTIS, PC A05/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90004421	MF-712
89-8249	15:6481	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003185	MF-700
SCIENTIFIC–					
2	15:6012	*See* AD-A–211553/3/XAB			

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
SCIPP–					
88/40	15:5780	NTIS, PC A02/MF A01; OSTI; INIS		DE90003724	MF-414
89/51	15:6056	*See* SLAC-PUB–5139			
SECA–					
89-10	15:5673	*See* N–89-26900			
SERI–					
9009462	15:4956	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009462	MF-232
SERI/PR–					
213-3590	15:4931	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009500	MF-270
SERI/SP–					
220-3024	15:4935	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89000838	MF-262
SERI/STR–					
211-3584	15:5457	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89009497	MF-271
SESL–					
249D541	15:5219	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN			
SI–					
1-1989	15:4909	Available on loan from Risoe Library, DK-4000 Roskilde			
SIS–					
1989:1	15:5261	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610374	
SJF-Beretning–					
41	15:4915	Available on loan from Risoe Library, DK-4000 Roskilde			
SKB-JSSP-TR–					
88-02	15:4868	NTIS (US Sales Only), PC A12/MF A01 - OSTI; INIS		DE90610977	
SLAC-CN–					
372	15:5715	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003763	MF-414
SLAC-PUB–					
5072	15:5781	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90004426	PC-414
5073	15:5722	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90004427	PC-414
5105	15:5782	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90004429	PC-414
5114	15:6055	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90004420	PC-414
5122	15:5783	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90004430	PC-414
5126	15:5710	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90004431	PC-414
5139	15:6056	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90004433	PC-414
SLAC/AP–					
77	15:5714	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003764	MF-414
SOL–					
89-17	15:6482	NTIS, PC A08/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003538	MF-405
SPC–					
532G546-Vol.1	15:4987	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN			
532G546-Vol.2	15:4988	Canadian Electrical Association, Research & Development, Suite #500, One Westmount Square, Montreal, PQ, CAN H3Z 2P9. Prices: $75.00 NON-MEMBERS; MEMBERS: PRICES UPON REQUEST, FUNDS CAN			
SRD-R–					
453	15:5902	H.M. Stationery Office, London, price Pound 5.00			
SSC/TLB–					
S52-2-183	15:5880	PC Canadian Government Publishing Centre, Supply and Services Canada, Ottawa, ON, CAN K1A 0S9; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
SSI–					
89-03	15:6216	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610875	
89-08	15:6217	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610876	

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
SSS-R–					
79-3973	15:5808	NTIS, PC A05/MF A01 - OSTI		DE90003444	
STUB–					
19	15:4914	Available on loan from Risoe Library, DK-4000 Roskilde			
34	15:4920	V/MF A01		DE90719281	
STUK-B-YTO–					
48	15:5071	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610185	
TC–					
T1-8-1988	15:4704	PC Transport Canada, Library and Information Centre, Place de Ville, Tower C, Ottawa, ON, CAN K1A 0N5; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC PRICES UPON REQUEST; MF $10 CAN			
TR-EL–					
82-4/82(11.114)	15:5847	*See* BR–82(11.114)			
UCID–					
21543	15:5694	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90004438	
21619	15:5644	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90004439	MF-706
21748	15:6371	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90004440	MF-712
21755	15:5605	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90004441	MF-701
21763	15:5805	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90004442	MF-741
21819	15:5730	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90004443	MF-712
21820	15:5206	*See* NUREG/CR–5470			
21826	15:5809	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90004445	MF-700
UCRL–					
100354	15:5695	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002980	MF-706
100359	15:6330	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002978	MF-706
100496	15:5817	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012933	MF-706
100532	15:6376	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002812	MF-706
100557	15:6483	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89008036	MF-705
100585	15:6048	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002808	MF-706
100649	15:5458	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002700	MF-706
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100671	15:6484	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89012368	MF-705
100805	15:6331	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003451	MF-700
100837	15:5810	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003596	MF-703
100961	15:5811	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003615	MF-700
101071	15:5696	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003605	MF-706
101076-Rev.1	15:6485	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003614	MF-705
101350	15:5459	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002993	MF-706; MF-704
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101559	15:5812	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89016513	MF-703
101579	15:5792	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003452	MF-706
101594	15:5395	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002768	MF-361
101602	15:5531	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003050	MF-704
101615	15:4869	NTIS, PC A02/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003623	MF-814
101623	15:5532	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89017729	
101630	15:5784	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002981	MF-706
101633	15:5697	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002994	MF-706
101663	15:6377	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003051	MF-712
101677	15:5352	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002753	MF-706
101837	15:5842	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002788	MF-702
101882	15:4870	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001168	MF-700
101939	15:5800	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003052	MF-706
101955	15:5813	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003616	MF-700
102001	15:5396	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90001167	MF-334
102036	15:5460	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003601	MF-704
102059	15:6486	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003604	MF-705
102123	15:4742	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002237	MF-123
102147	15:5381	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002805	MF-361
102150	15:6002	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE90003599	MF-700
102155	15:5785	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003621	MF-700
102168	15:5973	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003603	MF-706
21172	15:5881	NTIS, PC A11/MF A01 - OSTI		DE90003624	MF-702
21230	15:5657	NTIS, PC A09/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003027	MF-700
21232	15:4645	NTIS, PC A04/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003598	MF-103

Report Number	Abstract Number	Source of Availability	GPO Dep.	Order Number	Distribution Category
21247	15:6329	NTIS, PC A06/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90003472	MF-706
97251	15:6372	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002984	MF-705
97924	15:6373	NTIS, PC A02/MF A01 - OSTI		DE90002889	MF-712; MF-706
98598	15:5528	NTIS, PC A02/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002991	MF-701
98989	15:6374	NTIS, PC A03/MF A01; OSTI; INIS; GPO Dep.	E 1.99:	DE89012301	MF-712
99302	15:6375	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE90002806	MF-712
99677	15:5645	NTIS, PC A03/MF A01 - OSTI; GPO Dep.	E 1.99:	DE89015452	MF-706
UFRJ-COPPE-GAPS–					
01/83	15:5125	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90608658	
02/83	15:5072	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608740	
03/83	15:5073	NTIS (US Sales Only), PC A05/MF A01 - OSTI; INIS		DE90608741	
04/83	15:5126	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90608659	
05/83	15:5127	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90608660	
06/83	15:5151	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90608661	
UJV–					
8701-T	15:5208	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608781	
8727-R	15:5120	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90608886	
8734-M	15:5074	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90608742	
UKAEA-CS-R–					
001(R)	15:5105	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610200	
UNC/GJ–					
49(TMC)	15:4880	*See* DOE/ID/12584–45			
USAFOEHL–					
89-023RC0111DRA	15:5959	*See* AD-A–211759/6/XAB			
USIP–					
89-03	15:6177	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610720	
UTEC–					
89-036	15:5958	*See* AD-A–211612/7/XAB			
UVA–					
525659/EE90/101	15:5621	*See* AD-A–211607/7/XAB			
UWSEA-PUB–					
89-20	15:6055	*See* SLAC-PUB–5114			
UzIYaF-R–					
2-285	15:5509	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90610769	
3-336	15:5560	NTIS (US Sales Only), PC A03/MF A01 - OSTI; INIS		DE90609295	
9-263	15:6234	NTIS (US Sales Only), PC A02/MF A01 - OSTI; INIS		DE90609015	
VSJ–					
8901	15:5974	NTIS (US Sales Only), PC A06/MF A01		DE90724785	
VTT-EKA-B–					
6	15:6456	NTIS (US Sales Only), PC A04/MF A01 - OSTI; INIS		DE90608894	
WAES-TR–					
89-0010	15:5405	*See* AD-A–211406/4/XAB			
WHC-SA–					
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89-03864	15:5283	PC Yukon Territory. Bureau of Statistics, PO Box 2703, Whitehorse, YU, CAN Y1A 2C6; MF CANMET/TID, Energy, Mines and Resources Canada, 555 Booth St., Ottawa, Ont., Canada K1A 0G1. Prices: PC N/C; MF $10 CAN			

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DE90608323	INIS-BR–1757
DE90608568	IAEA-TECDOC–515
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DE90608624	AEEW-M–2507-Issue2
DE90608643	AEEW-R–2411
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DE90608646	CTA-IEAv-RP–029/89
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TD Chad
TG Togo
TH Thailand
TN Tunisia
TO Tonga
TR Turkey
TT Trinidad and Tobago
TW Taiwan
TZ United Republic of Tanzania

UA Ukrainian Soviet Socialist Republic (Ukrainian SSR)
UG Uganda
US United States of America (USA)
UY Uruguay

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